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**Supplement**  
to the Proceedings of the  
42nd Annual Symposium on Frequency Control 1988

**Subject and Author Index**  
for the Proceedings  
of the 10th to 42nd  
Symposia on Frequency Control  
and  
**Symposium Historical Information**  
1946 - 1988

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# Background and Early Sessions of the Frequency Control Symposium

Willie L. Doxey, retired\*

The commitment of the Chief Signal Officer in early 1940 to equip the Army Combat Forces with radio communications using piezoelectric quartz crystals for frequency control was indeed a bold, yet sound, decision. The initial engineering development, prototype models, and field testing proved conclusively that the quartz crystal was essential to assure the military of reliable communications under combat conditions. However, adequate information was not available at that time to properly expose the astronomical problems of expanding and modernizing an industry capable of producing the number and variety of quartz crystal units to meet mobilization schedules for communications equipments required by the Armed Forces. cursory inventory of the total production of quartz crystals (of all types) in the years of 1939 and 1940 turned out to be, at most, only a few thousand compared to the several million required at the beginning of 1942. During a special review of this critical production problem, a suggestion was made by the Senior Field Commander of the Armored Forces (on maneuvers at the time) to return to the old model radio without the use of quartz crystals. At this remark, General James D. O'Connel stated, with some authority: "Yes, we can give you those radios; but with quartz crystals we can give you communications."

During the war years of 1942-45, the crystal manufacturers, with unstructured support of the three services (Army, Navy, and Air Force), sponsored "production forums" which met monthly, in conveniently located cities, for discussions of those problems related to the production, testing, packaging, etc., of crystals for the military services. These meetings provided a valuable communications network and, more important, provided a platform for exchanges of technical information and production problems in this narrow field of new technology. After the war, however, only a relatively few of the crystal companies remained active. Military requirements for production (of existing types) were simply nonexistent.

During the last years of war (1944-45), the three services (Army, Navy, and Air Force), and the National Bureau of Standards, along with the Bell Telephone Laboratories, and universities (among others), had become more keenly aware of the lack of scientific knowledge of the properties of the quartz crystal. Interest and support expanded rapidly in the military services to provide resources for research and development, as well as refined techniques and

equipment for the production of piezoelectric devices. All three services expanded their fiscal capabilities to include sizeable research and development of internal and contractual programs to meet their projected, new and improved crystal requirements. The Army program, keynoted by positive direction of General James D. O'Connel to wit, "We must never again be caught, as we were in 1941-42, without a superior base of technology, trained engineers, and upgraded facilities to accomplish the Army's mission in communication on a timely basis."

With the support and direction of General O'Connel (who subsequently became Chief Signal Officer of the Army), several actions were made possible:

1. Funding for frequency-control programs for research and development contracts was increased substantially, exact figures are not available. However, if we suggest a figure of one and one half million dollars, as an initial start (with the buying power of 1946 dollars), this was considered a very worthwhile effort.

2. The Fort Monmouth Frequency Control Activity, at the close of World War II, retained its identity, thus surviving serious reductions in personnel, particularly engineers and technicians.

3. The Army's Frequency Control activities (internal and external) have survived a number of command reorganizations (or restructurings), and maintain a very healthy "Laboratory" identity.

Throughout the World War II years of 1941 through 1945, production of war support materiel was of the highest priority. Engineers and technicians were totally engaged in production support. The quartz crystal production program was among the 10 highest priority items in the total Army program. Engineers in the crystal industry (and in the government) identified problems in the design, production, and performance of crystal units (as well as test and measurement equipment), which required research and development efforts. As a result, when the war ended, there was an abundance of proposed tasks and projects requiring development work, engineering design (redesign), and research investigations. Unsolicited proposals were being received by R&D activities of all three services (Army, Navy, and Air Force), and in many instances the same proposal found its way into each of the services for support. Although coordination among the three services was very good, at laboratory levels, the potential, as well as actual overlap and duplication of efforts, suggested/demanded a coordinated review at laboratory levels on an annual basis by engineering and top management personnel from the three services.

\*Willie L. Doxey was Chief of the Frequency Control Branch, Signal Corps Engineering Laboratories, Fort Monmouth, NJ, during the early days of the Symposium, prior to the publication of the first Proceedings.

In the absence of a structured organization to review and coordinate the research and development in this new and important field of Frequency Control, representatives of the Army, Navy, and Air Force (with participation of the National Bureau of Standards, experts from commercial R&D laboratories, and manufacturers), initiated action to formalize an annual review of problems, progress, and programs in this rapidly growing field of frequency control.

The first "Conference on Frequency Control" was held in 1946 in the conference room of Squire Signal Laboratory, Fort Monmouth, NJ, under Signal Corps sponsorship, with the participation of Air Force, Navy, and industry. Approximately 65 people attended. The agenda was flexible, with informal presentations by engineers of the three services, covering, primarily, their internal programs and contractual requirements, followed by a tour of the facilities and internal activities of the Frequency Control Branch of Squire Signal Laboratory. Informal presentations were made by engineers from R&D contractors and other technical representatives from commercial manufacturers and laboratories. Interesting and profitable discussions followed each presentation. Attendees expressed opinions that this technical meeting was very worthwhile, and that a similar meeting should be held annually. No formal reports were prepared; however, the informal notes and discussions proved valuable. The next three annual reviews were also held at the Fort Monmouth facility. Attendance increased substantially each year, and soon exceeded the capacity of facilities available at Fort Monmouth. The conferences were then held at the Berkeley-Carteret Hotel in Asbury Park, NJ, where they were entitled Symposium. Invitations and formal agenda were prepared and issued by the Frequency Control Branch; however, no proceedings were prepared of the first nine symposia. Beginning with the 10th Frequency Control Symposium, formal papers were required, and proceedings were prepared and distributed.

The major technical areas of research, development and production explored during the first nine Frequency Control Symposia were as follows:

- O Quartz Crystals
- O Other Crystals Having Piezoelectric Properties
  - Such as: Tourmaline,
  - Aluminum Phosphate,
  - Nepheline
- O High Pressure Crystal Growing Techniques
- O Defects in Quartz
- O Piezoelectric Oscillators
- O Processing Technology
  - Plating (Materials)
  - Polishing
  - Mounting, etc.
- O Crystal Holders
  - Metal, Phenolic, Glass
- O Hermetic Sealing
- O Aging Studies
- O High Precision Crystals and Oscillators
- O Temperature Control (Ovens)

- O Mass Production - Techniques, Equipments, Automation
- O Measurement Methods

Atomic and molecular frequency standards were first addressed at the Symposium in the mid-1950's.

The symposium remained at the Berkeley-Carteret Hotel until 1959; after which time it was transferred to the Shelburne Hotel in Atlantic City, NJ, where it remained until 1971. The Symposium soon reached an attendance of several hundred engineers and scientists from a number of domestic and foreign countries.

In 1972, the Symposium moved to the Howard Johnson's Motor Lodge in Atlantic City. In 1973, due to a major fire at the Howard Johnson's a few months prior to the Symposium, the Symposium was moved to the Cherry Hill Inn, Cherry Hill, NJ. In 1974, the Symposium returned to Howard Johnson's, and remained there until 1979 (which is about the time that gambling became legal in Atlantic City). From 1980 to 1987, the Symposium was held in Philadelphia, PA.

Sponsorship and management of the Symposium remained with the leadership of the Frequency Control Branch of Fort Monmouth, NJ until 1981. There was no registration fee charged up to 1981. Because the costs, in terms of both manpower and dollars, became an increasing burden on the Frequency Control Branch, a contractor was hired in 1981 to assist with the administrative aspects of the Symposium, and a registration fee was instituted in 1982. By this time, the Symposium had long ago developed into the premier international scientific and engineering meeting in the area of frequency control. Discussions of defense related frequency control issues were no longer the focus. In 1983, a Memorandum of Understanding for cosponsorship of the Symposium was signed between the Director, U.S. Army Electronics Technology and Devices Laboratory and the President, Institute of Electrical and Electronics Engineers, Sonics and Ultrasonics Group. The Sonics and Ultrasonics Group changed its name shortly thereafter to the IEEE Ultrasonics, Ferroelectrics and Frequency Control Society.

As long as the Frequency Control Branch provided the manpower for administering the Symposium, it was necessary for the Symposium to be located in the vicinity of Fort Monmouth, NJ. With the changes implemented between 1981 and 1983, this was no longer essential. The Symposium management, therefore, decided to change the Symposium location annually, starting with the 1988 Symposium.

## Symposium Chairmen, 1956-1988

Year	General Chairman	Technical Program Chairman	Other
1956	Eduard A. Gerber	Personnel of the Frequency Control Branch, US Army Signal Corps Engineering Laboratories	
1957	Eduard A. Gerber	J.M. Havel, R. Bechmann, M. Bernstein, G.K. Guttwein, F.H. Reder	Arrangements: Clarence E. Searles, Ruth C. Jenny
1958	Eduard A. Gerber	Jerome M. Havel	Arrangements: Clarence E. Searles, Ruth C. Jenny Facilities: Millard F. Timm
1959	Eduard A. Gerber	Jerome M. Havel	Arrangements: Clarence E. Searles Facilities: Millard F. Timm
1960	Eduard A. Gerber	Jerome M. Havel	Arrangements: Clarence E. Searles Facilities: Millard F. Timm
1961	Eduard A. Gerber	Jerome M. Havel	Arrangements: Clarence E. Searles Facilities: Millard F. Timm
1962	Eduard A. Gerber	Jerome M. Havel	Arrangements: Millard F. Timm
1963	Eduard A. Gerber	Gunter K. Guttwein	Arrangements: Millard F. Timm
1964	Eduard A. Gerber	Gunter K. Guttwein	Arrangements: Millard F. Timm
1965	Eduard A. Gerber	Gunter K. Guttwein	General Vice Chairman: Vincent J. Kublin Executive Assistant: Millard F. Timm Publications & Publicity: Mrs. P. Goldon Local Arrangements: Millard F. Timm
1966	Vincent J. Kublin	Gunter K. Guttwein	Executive Assistant: Millard F. Timm Publications & Publicity: Marilyn Herberg Local Arrangements: Millard F. Timm
1967	Vincent J. Kublin	Gunter K. Guttwein	Executive Assistant: Millard F. Timm Publications & Publicity: Marilyn Herberg Local Arrangements: Millard F. Timm
1968	Vincent J. Kublin	Gunter K. Guttwein	Executive Assistant: Millard F. Timm Publications & Publicity: Marilyn Herberg Local Arrangements: Arthur D. Ballato
1969	Vincent J. Kublin	Gunter K. Guttwein	Executive Assistant: Millard F. Timm

Year	General Chairman	Technical Program Chairman	Other
			Local Arrangements: Joseph M. Stanley
1970	Vincent J. Kublin	Gunter K. Guttwein	Executive Assistant: Joseph M. Stanley Staff Consultant: Millard F. Timm
1971	Vincent J. Kublin	Gunter K. Guttwein	Executive Assistant: Joseph M. Stanley Staff Consultant: Millard F. Timm
1972	Vincent J. Kublin	Erich Hafner	Executive Assistant: Joseph M. Stanley Staff Consultant: Millard F. Timm
1973	Milton Tenzer	Erich Hafner (ECOM) A.R. Chi (NASA)	Executive Assistant: John Vig
1974	Milton Tenzer Erich Hafner	Erich Hafner	Executive Assistant: John Vig
1975	Milton Tenzer Erich Hafner	Erich Hafner	Exec. Asst.: John Vig Secretary: Lee Hildebrandt
1976	Milton Tenzer Erich Hafner	Erich Hafner	Executive Assistant: John Vig Secretary: Lee Hildebrandt
1977	Erich Hafner	Erich Hafner	Executive Assistant: John Vig Executive Secretary: Lee Hildebrandt
1978	Erich Hafner	Erich Hafner	Executive Assistant: John Vig Executive Secretary: Lee Hildebrandt
1979	Erich Hafner	Erich Hafner	Executive Secretary: Lee Hildebrandt
1980	Erich Hafner	Erich Hafner	Executive Secretary: Lee Hildebrandt
1981	Erich Hafner	Erich Hafner Arthur Ballato	Executive Secretary: Lee Hildebrandt
1982	Vladimir G. Gelnovatch	Arthur Ballato	
1983	John R. Vig	Samuel R. Stein	
1984	John R. Vig	Samuel R. Stein	
1985	John R. Vig	Samuel R. Stein	Finance Chairman: Thomas Parker
1986	John R. Vig	Leonard S. Cutler	Finance Chairman: Thomas Parker Publicity Chairman: Raymond Filler
1987	John R. Vig	Leonard S. Cutler	Finance Chairman: Thomas Parker Publicity Chairman: Raymond Filler
1988	John R. Vig	Thrygve R. Meeker	Finance Chairman: Raymond Filler Local Arrangements Chairman: Michael Driscoll

## Symposium Awards, 1966-1988

From 1966 to 1982, only one award, the C.B. Sawyer Memorial Award, had been presented at the Frequency Control Symposium. According to the Sawyer Award announcement, the Award is "to consist of \$500.00 and a plaque, shall be made on an annual basis to the person, or the group of persons, who, in the opinion of an independent three-man judging committee, has made the most outstanding recent contribution to advancement in the field of quartz crystals and devices. No award will be made in a year in which the committee determines that no award is warranted. Presentations will be made at the Frequency Control Symposium."

Aside from permitting the presentation of the Sawyer Award at the Symposium Banquet, the Symposium's management has had no involvement with the Sawyer Award. The Award is sponsored by Sawyer Research Products, Inc.; the judging committee is selected by that company. The first Sawyer Award was presented in 1966. It has been presented each year since then, except in 1982, when no suitable award nominations were received.

In the early 1980's, sentiment was expressed at Symposium program committee meetings for the creation of awards to recognize outstanding contributions in all fields covered by the Symposium, not just in the field of quartz crystals and devices. Therefore, in early 1983, the program committee voted to create two new awards. One, the Cady Award, named after Walter Guyton Cady, is to recognize outstanding contributions related to piezoelectric frequency control devices. The other, the Rabi Award, named after Prof. I.I. Rabi, is to recognize outstanding contributions related to fields such as atomic and molecular frequency standards, and time transfer and dissemination. Each award consists of \$500.00, and a limited edition original print and certificate in a leather binder. The awards are presented to the recipients at the Symposium.

### SAWYER AWARD WINNERS, 1966 to 1982:

- 1966 - Warren P. Mason: "For outstanding contributions in quartz crystal devices, particularly in the field of frequency selection" and  
Rudolf Bechman: "For outstanding contributions in quartz crystal devices, particularly in the field of frequency control."
- 1967 - Raymond D. Mindlin: "For fundamental contributions to the theory of vibration in piezoelectric resonators leading directly to advancements in the art."
- 1968 - Daniel R. Curran: "For original and imaginative design of multielectrode piezoelectric resonators, contributing significantly to the rapid advance of the quartz filter art in the past few years" and  
David B. Fraser: "For contributions to the knowledge of the mechanisms of acoustic loss in crystalline quartz, and the evaluation of this acoustic loss by optical methods."
- 1969 - Arthur W. Warner, Jr.: "Contributions to the development of high frequency thickness shear quartz resonators for precise frequency control and as an aid to the measurement of the intrinsic Q of quartz material."
- 1970 - Issac Koga: "Theoretical and experimental investigations of quartz and tutorial leadership in the field of piezoelectric crystals."
- 1971 - Donald L. Hammond: "For development and applications of crystal devices to highly precise frequency control, and temperature and pressure instrumentation."
- 1972 - W.J. Spencer: "For advances in the theory and development of piezoelectric crystal devices."
- 1973 - James C. King: "For major contributions to the understanding of the fundamental properties of quartz crystals, and methods for improvement of these properties in synthetic quartz."
- 1974 - Robert A. Laudise, Robert A. Ballman and David W. Rudd: "For outstanding contributions to the synthesis of crystalline quartz with special properties for resonator applications."
- 1975 - Morio Onoe: "For theoretical and practical contributions in the field of frequency control and selection, as well as leadership in national and international committees on piezoelectric devices."
- 1976 - Warren L. Smith: "For outstanding contributions in the field of precision crystal controlled oscillators of high spectral purity and monolithic crystal filters."
- 1977 - Virgil E. Bottom: "In recognition of theoretical and practical contributions to the Quartz Crystal Industry, and inspiration to his students to choose this field of endeavor."

- 1978 - Arthur D. Ballato: "For contributions in the field of piezoelectric crystals such as; stacked filters, electric circuit analogues and stress effects in doubly rotated plates."
- 1979 - Harry F.R. Tiersten: "For contributions to the theory of piezoelectric resonators."
- 1980 - Peter Chung-Yi Lee: "For contributions to the theory of vibrations in quartz crystal plates."
- 1981 - Eduard A. Gerber: "For pioneering research in VHF and UHF precision oscillators and filter crystals and international leadership in the field of frequency control" and Roger A. Sykes: "For outstanding contributions in the development and application of quartz crystals in the frequency control industry."
- 1982 - No award given in this year (due to lack of suitable award nominations).

AWARD WINNERS, 1983 to 1988:

Year	Cady Award	Rabi Award	Sawyer Award
1983	Errol P. EerNisse "For his theoretical prediction of planar stress compensation in doubly rotated quartz plate resonators leading to the realization of the SC-cut."	I.I. Rabi "For theoretical and experimental contributions to atomic beam resonance spectroscopy leading to the development of practical atomic frequency standards."	Erich Hafner "For technical contributions and leadership in the fields of quartz resonator research, technology and measurement, and high precision frequency control."
1984	Arthur W. Warner "For his contributions to the development of high precision quartz crystal units."	David W. Allan "For his contributions to the statistics of atomic clocks, measurement techniques, time scale and time coordination and distribution."	William B. Benedick, Robert A. Graham and Frank W. Neilson "For their fundamental experimental studies of the physical properties of crystalline quartz under extreme pressures and rates of loading leading to applications including a high pressure quartz stress gauge with nano-second time resolution."
1985	John A. Kusters "For his contributions to the development of SC-cut and other doubly rotated quartz resonators."	Norman Ramsey "For his contributions to the development of atomic frequency standards."	Thrygve Meeker "For his contributions to the theory and design of piezoelectric quartz devices."
1986	Juergen H. Staudte "For his pioneering contributions to the photolithographic processing of quartz devices, especially the development and commercialization of quartz tuning forks for timekeeping."	Jerrold R. Zacharias "For his contributions to the development of atomic frequency standards, especially his scientific leadership, pioneering demonstration of the technology, and entrepreneurial initiative which led to the commercialization of atomic standards."	Larry E. Halliburton "For his contributions toward the characterization of cultured quartz using infrared absorption, electron spin resonance, acoustic loss, and thermoluminescence measurements."
1987	Virgil E. Bottom "For contributions to fundamental theory and experiments, stimulation of growth of the industry, and education in quartz resonator technology."	Louis Essen "For contributions to cesium atomic beam and quartz frequency standards."	John A. Kusters "In recognition of outstanding contributions in engineering, technology development and management relating to quartz crystals and devices."



Year	Cady Award	Rabi Award	Sawyer Award
1988	<p>Baldwin Sawyer</p> <p>"For his work leading to the development of improved cultured quartz crystals, improved qualification techniques, and his tireless contributions to the frequency control industry."</p>	<p>Gernot M.R. Winkler</p> <p>"For early development of worldwide clock synchronization through use of portable clocks; encouragement and support for the development of atomic frequency standards from their earliest days; and international leadership in the time and frequency community."</p>	<p>Charles A. Adams</p> <p>"For contributions to the development of unique devices and manufacturing technology."</p>

# INDEX TO THE PROCEEDINGS OF THE FREQUENCY CONTROL SYMPOSIUM 1956 (10TH) TO 1988 (42ND)

Prepared by: John R. Vig, US Army Electronics Technology and Devices Laboratory (LABCOM)

This index consists of a subject index and an author index. Each paper has been assigned to one of fourteen categories. The subject categories are as follows:

1. Fundamental Properties of Natural and Synthetic Piezoelectric Crystals
2. Theory and Design of Piezoelectric Resonators
3. Radiation Effects on Resonators and Oscillators
4. Resonator Processing Techniques and Aging
5. Filters, Surface and Shallow Bulk Acoustic Wave Devices, Other Nonquantum-electronic Microwave Resonators, and Non-Piezoelectric Acoustic Resonators
6. Quartz Crystal Oscillators and Frequency Control Circuitry
7. Quantum Electronic Frequency Standards (Microwave Frequencies)
8. Quantum Electronic Frequency Standards (Visible and Infrared Frequencies)
9. Frequency and Time Coordination and Distribution
10. Applications of Frequency Control Devices
11. Measurements and Specifications
12. Frequency Stability and Phase Noise (other than "measurement of")
13. Sensors and Transducers
14. Other Topics

The papers are listed first according to the subject categories. Within each subject category, the papers are listed in the order of the Proceedings volume numbers, then under each Proceedings volume, according to the page numbers. (There were no Proceedings published prior to the 10th Symposium.)

The papers are numbered according to the following numbering system:

first number = subject category  
second number = symposium number  
third number = page number of the first page of the paper

For example, paper number 11-24-301 is listed under category 11- Measurements and Specifications, it is in the Proceedings of the 24th Symposium, and the paper starts on page 301 of that Proceedings volume.

Users of this index are cautioned that each paper is assigned to only one subject category, even though most papers touch on more than one category.

In the author index, the names of the authors are listed alphabetically, and for each author, the papers are listed chronologically according to the Proceedings volume number.

This index is intended to be revised and updated periodically. Please send comments and corrections to:

John R. Vig  
US Army Electronics Technology and Devices Laboratory  
ATTN: SLCET-EQ  
Fort Monmouth, NJ 07703  
or telephone: (201) 544-4275 or (201) 544-4805.

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# **SUBJECT INDEX**

## **CATEGORY 1:**

### **Fundamental Properties of Natural and Synthetic Piezoelectric**

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| 1-10-75  | Growth of Quartz at High Temperature and Pressure in the United Kingdom - L.A. Thomas                       | 1-19-669 | Quality in Cultured Quartz - C.B. Sawyer   |
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| 1-30-129 | New Temperature Compensated Materials with High Piezoelectric Coupling - P.H. Carr and R.M. O'Connell  | 1-34-1   | Point Defects in Synthetic Quartz: A Survey of Spectroscopic Results with Application to Quality Assurance - L.E. Halliburton, M.E. Markes and J.J. Martin                       |
| 1-31-159 | The Electroelastic Tensor and Other Second Order Phenomena in Quasilinear Interpretation of the Polarizing Effect with Thickness Vibrations of a-Quartz Plates - C.K. Hruska | 1-34-9   | Electrical Conductivity and Dielectric Loss of Quartz Crystals Before and After Irradiation - A.S. Nowick and H. Jain  |
| 1-31-171 | Coercive Stress for Ferrobielastic Twinning in Quartz - T.L. Anderson, R.E. Newnham and L.E. Cross   | 1-34-14  | Studies of Micron Order Defects in Quartz by a High Angular Resolved X-Ray Small Angle Scattering Technique - C.K. Suzuki, F. Iwasaki and K. Kohra                               |
| 1-31-178 | Hydrothermal Synthesis of Aluminum Metaphosphate - E.D. Kolb and R.A. Laudise  | 1-34-25  | A New Method for Predicting the Temperature Dependence of Elastic Compliance in Simple Proper Ferroelectrics - L.E. Cross, R. Betsch, H. McKinstry, T. Shrout and R. Neurgaonkar |
| 1-31-182 | Temperature Compensated Cuts of Berlinite and $\beta$ Eucryptite for SAW Devices - R.M. O'Connell and P.H. Carr  | 1-34-65  | Factors Affecting the Quality and Perfection of Hydrothermally Grown Quartz - J.F. Balascio and N.C. Lias  |
| 1-32-1   | The Characterization of Synthetic Quartz By Using Infrared Absorption - J.C. Brice and A.M. Cole   | 1-34-81  | The Acoustic Loss Spectrum of 5MHz 5th Overtone AT-Cut Deuterated Quartz Resonators - J.J. Martin and S.P. Doherty   |
| 1-32-11  | Low Temperature Infrared Absorption of Impurities in High Grade Quartz - H.G. Lipson, F.K. Euler and A.F. Armington  | 1-34-85  | The Temperature Coefficient of Frequency of AT-Cut Resonators Made from Cultured r-Face Quartz - T.R. Meeker and A.J. Miller   |
| 1-32-24  | Steady State Radiation Effects in Precision Quartz Resonator - F.K. Euler, P.A. Ligor, A. Kahan, P. Pellegrini, T.M. Flanagan and T.F. Wrobel                                |          |  |
| 1-32-34  | Radiation Induced Frequency and Resistance Changes in Electrolyzed High Purity Quartz Resonators - T.J. Young, D.R. Koehler and R.A. Adams                                   |          |  |

# CATEGORY 1 (Cont'd):

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| 1-34-93  | Experimental Thermal Behavior of Berlinite Resonators - J. Detaint, H. Poignant and Y. Toudic   | 1-36-115 | Characterization of Alkali Impurities in Quartz - F.K. Euler, H.G. Lipson, A. Kahan and A.F. Armington   |
| 1-34-102 | Netplane Data for Quartz, Berlinite, LiTaO <sub>3</sub> and LiNbO <sub>3</sub> - E. Knolmayer   | 1-36-124 | The Elastic, Dielectric and Piezoelectric Constants of Berlinite - D.S. Bailey, W. Soluch, D.L. Lee, J.F. Vetelino, J.C. Andle and B.H.T. Chai   |
| 1-35-291 | Recent Progress on Aluminum Phosphate Crystal Growth - E.D. Kolb and R.A. Laudise   | 1-36-159 | Elastic Constants of Quartz and Their Temperature Coefficients - A. Kahan  |
| 1-35-297 | Initial Results With The Air Force Hydrothermal Facility - A.F. Armington, J.J. Larkin, J.J. O'Connor and J.A. Horrigan   | 1-36-187 | Photoluminescence from Worked Surface Layers and Frequency Instability of Quartz Resonators - A. Halperin, S. Katz and M. Ronen  |
| 1-35-304 | Synthetic Quartz Crystals Grown in NaCl, KCl Solutions and Pure Water, and Their Low Temperature Infrared Absorption - M. Hosaka, S. Taki, K. Nagai and J. Asahara                                  | 1-36-193 | Growth Tunnels in Quartz Crystals - S. Katz, A. Halperin and M. Schieber   |
| 1-35-312 | The Influence of the Quality Factor of Quartz on Some Device Properties - J.C. Brice, E.D. Fletcher and J. Dowsett  | 1-37-111 | Non-Destructive Observation of Random Electrical Twinning in Cultured Quartz - H. Merigoux, J.F. Darces, P. Zecchini and J. Lamboley   |
| 1-35-317 | Point Defects in Cultured Quartz: Recent Acoustic Loss, Infrared, and Magnetic Resonance Results - J.J. Martin, L.E. Halliburton and R.B. Bossoli   | 1-37-116 | Tensile Fracture Strength of ST-Cut Quartz - H.L. Chao and T.E. Parker   |
| 1-35-329 | High Temperature Resonance Loss and Infrared Characterization of Quartz - H.G. Lipson, A. Kahan, R.N. Brown and F.K. Euler  | 1-37-125 | Effect of Alkali Ions on Electrical Conductivity and Dielectric Loss of Quartz Crystals - J. Toulouse, E.R. Green and A.S. Nowick  |
| 1-36-55  | Recent Results with the Air Force Hydrothermal Facility - A.F. Armington, J.J. Larkin, J.J. O'Connor and J.A. Horrigan  | 1-37-136 | The Bulk Acoustic Wave Properties of Lithium Tetraborate - C.D.J. Emin and J.F. Werner   |
| 1-36-62  | Growth and Characterisation of High Purity Quartz - D.F. Croxall, I.R.A. Christie, J.M. Holt, B.J. Isherwood and A.G. Todd  | 1-37-144 | Sputtered c-axis Inclined Piezoelectric Films and Shear Wave Resonators - J.S. Wang, K.M. Lakin and A.R. Landin  |
| 1-36-66  | Radiation Effects in Synthetic and High Purity Synthetic Quartz: Some Recent Infrared, Electron Spin Resonance and Acoustic Loss Results - S.P. Doherty, S.E. Morris, D.C. Andrews and D.F. Croxall | 1-37-151 | Recalibration of Q Capability Indications from Infrared Measurements on Cultured Quartz - C.B. Sawyer  |
| 1-36-77  | The Influence of Crystal Growth Rate and Electrodiffusion (Sweeping) on Point Defects in $\alpha$ -Quartz - J.J. Martin, L.E. Halliburton, R.B. Bossoli and A.F. Armington                          | 1-37-153 | Pressure-Volume-Temperature Behavior in the System H <sub>2</sub> O-NaOH-SiO <sub>2</sub> and its Relationship to the Hydrothermal Growth of Quartz - E.D. Kolb, P.L. Key, R.A. Laudise and E.E. Simpson |
| 1-36-82  | A Comparison of Quartz Crystals Grown from Fused Silica and from Crystalline Nutrient - R.J. Baughman   | 1-37-157 | Standard Characterization Methods for the Determination of the Quality of Hydrothermally Grown Quartz - J.F. Balascio and N.C. Lias  |
| 1-36-97  | Electroelastic Effects and Impurity Relaxation in Quartz Resonators - R. Brendel and J.J. Gagnepain   | 1-37-164 | Electrodiffusion of Charge-Compensating Ions in Alpha-Quartz - J.J. Martin, R.B. Bossoli, L.E. Halliburton, B. Subramaniam and J.D. West   |
|          |   | 1-37-169 | Aluminum and Hydroxide Defect Centers in Vacuum Swept Quartz - H.G. Lipson, A. Kahan and J.J. O'Connor   |

# CATEGORY 1 (Cont'd):

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| 1-37-177 | Effect of Seed Treatment on Quartz Dislocations - A.F. Armington, J.J. Larkin, J.J. O'Connor, J.E. Cormier and J.A. Horrigan  | 1-39-247 | The Influence of Temperature and Electric Field on the Etch-Channel Density in Swept Cultured Quartz - J.G. Gualtieri   |
| 1-37-181 | Thermoluminescence from Different Growth Sectors in Synthetic Quartz Crystals - S. Katz, A. Halperin and M. Ronen   | 1-39-255 | Defect Centers in Irradiated and Swept Quartz - A. Kahan and H.G. Lipson  |
| 1-37-185 | Characterization of Quartz Crystals by Cathodeluminescence - S. Katz, A. Halperin and M. Schieber   | 1-39-282 | Effect of Crystal Orientation on the Surface Texture of Chemically Etched Quartz Plates, The Case of Cuts Close to the AT-Cut - C.R. Tellier  |
| 1-38-3   | The Growth of High Purity Low Dislocation Quartz - A.F. Armington and J.F. Balascio   | 1-40-26  | Computer Modeling of Point Defects in Quartz - T.M. Wilson, L.E. Halliburton, M.G. Jani and J.J. Martin   |
| 1-38-8   | Cultured Quartz of Low Aluminum Content from Production Sized Autoclaves - C.B. Sawyer and D.R. Kinloch   | 1-40-32  | A Radiation Growth Study of Acoustic Loss Related Defects in Alpha-Quartz - J.J. Martin, H.B. Hwang and T.M. Wilson   |
| 1-38-10  | Distribution of Aluminum and Hydroxide Defect Centers in Irradiated Quartz - H.G. Lipson and A. Kahan   | 1-40-39  | Characterization of Brazilian Lascas from Various Regions and Their Use for Synthetic Quartz Growth - Part I. Lascas Study - H. Iwasaki, F. Iwasaki, C.K. Suzuki, V.A.R. Oliveira, D.C.A. Hummel and A.H. Shinohara           |
| 1-38-16  | Aluminum-Related Acoustic Loss in AT-Cut Quartz Crystals - J.J. Martin  | 1-40-47  | Characterization of Brazilian Lascas from Various Regions and Their Use for Synthetic Quartz Growth - Part II. Properties Correlation - C.K. Suzuki, A.H. Shinohara, V.A.R. Oliveira, S. Takiya and J. Kiss                   |
| 1-38-22  | The Constants of Alpha Quartz - R.W. Ward   | 1-40-54  | On the Disagreement in the Order of Magnitude of the Electroelastic Constants of Alpha-Quartz - C.K. Hruska   |
| 1-38-38  | Probable Ion Signature in Quartz Electrodiffusion Data - W.P. Hanson  | 1-40-63  | Infrared and Laser Spectroscopic Characterization of Aluminum Defects in Cultured Quartz - H.G. Lipson  |
| 1-38-42  | Sweeping and Irradiation Studies in Quartz - J.G. Gualtieri and J.R. Vig  | 1-40-70  | Developmental Results for the Production of High Quality Quartz - J.F. Balascio and A.F. Armington  |
| 1-38-50  | Computer Controlled Quartz Electrodiffusion (Sweeping) with Real Time Data Collection - W.P. Hanson   | 1-40-76  | Experimental Study and Numerical Simulation of Quartz Crystal Etched Figures - C.R. Tellier, N. Vialle and J.L. Vaterkowski   |
| 1-38-105 | Etch Figures and Etch Rate in AT, BT, X, and Y-cut Plates - C.R. Tellier  | 1-40-91  | Quartz Analogues - J.H. Sherman, Jr.  |
| 1-39-223 | Characteristics of Natural, Swept Natural, and Cultured X- and Z-Growth Quartz Material in High Temperature, High Stress Applications - J.A. Kusters and G.S. Kaitz                 | 1-40-101 | Berlinite: Characterization of Crystals with a Low Water Concentration and Design of Bulk Wave Resonators - J. Detaint, A. Zarka, B. Capelle, Y. Toudic, J. Schwartzel, E. Philippot, J.C. Jumas, A. Goiffon and J.C. Doukhan |
| 1-39-230 | The Growth of High Quality Quartz in Commercial Autoclaves - A.F. Armington and J.F. Balascio   | 1-40-121 | Impurities Migration Study in Quartz Crystal Resonators by Using Electroelastic Effect - R. Brendel, J.J. Gagnepain and J.P. Aubry  |
| 1-39-234 | Crystal Growth, Physical Characterization and B.A.W. Devices Applications of Berlinite - J. Detaint, J. Schwartzel, E. Philippot, J.C. Jumas, A. Zarka, B. Capelle and J.C. Doukhan |          |   |

# CATEGORY 1 (Cont'd):

- 1-41-167    Electrodiffusion or Sweeping of Ions  
             in Quartz - J.J. Martin
- 1-41-175    Etch Channels in Single Crystal  
             Cultured Quartz - G.R. Johnson and  
             R.A. Irvine
- 1-41-183    Etch Pits and Channels in Swept AT-  
             and SC-Cut Quartz - J.R. Hunt
- 1-41-192    Further Studies on Electrode-  
             Diffusion-Suppressed-Swept Quartz  
             - J.G. Gualtieri
- 1-41-213    A Study of Dislocations and  
             Inclusions in Alpha Quartz - A.F.  
             Armington, J.A. Horrigan, M.T.  
             Harris and J.F. Balascio
- 1-41-223    Dielectric Relaxation and EPR in  
             Quartz Crystals Containing Fe - S.  
             Keilson, S. Ling, A.S. Nowick and  
             L.E. Halliburton
- 1-41-228    Transmission X-Ray Topography of  
             Single Crystal Quartz Using White  
             Beam Synchrotron Radiation - W.P.  
             Hanson
- 1-42-53     Temperature Derivatives of the  
             Dynamic Permittivity and  
             Permeability of the Simple Thickness  
             Modes of Quartz Plates - J.A.  
             Kosinski, A.D. Ballato, T.J.  
             Lukaszek, M. Mizan, R. McGowan and  
             K. Kohn
- 1-42-116    High Performance Quartz (Invited  
             Paper) - R.A. Laudise, R.L. Barns,  
             D.S. Stevens, H. Brown and E.  
             Simpson
- 1-42-127    Recent Experiments in a Silver Lined  
             Autoclave - R.A. Irvine, J. Foise,  
             E. Leeson and G.R. Johnson
- 1-42-138    New Advances in Crystal Growth of  
             High Purity Berlinite: A New  
             Solvent the Sulfuric Acid - E.  
             Philippot, A. Goiffon, J.C. Jumas,  
             C. Avinens, J. Detaint, J.  
             Schwartzel and A. Zarka
- 1-42-146    A New Measurement of the Basic  
             Elastic and Dielectric Constants of  
             Quartz (Invited Paper) - B. James
- 1-42-155    Possible Mechanisms for the  
             Introduction of Hydrogen into Alpha-  
             Quartz During Sweeping - J.G.  
             Gualtieri
- 1-42-162    Evaluation of Resonators Fabricated  
             from High Quality Quartz - J.J.  
             Martin, A. Lopez, A.F. Armington and  
             J.F. Balascio
- 1-42-169    Dose Dependence of Radiation-Induced  
             Defect Changes in Quartz - H.G.  
             Lipson and F.K. Euler
- 1-42-176    A Production Study of Acoustic Loss  
             Related Defects in Quartz - A.  
             Lopez, H.B. Hwang and J.J. Martin
- 1-42-184    The Thermoluminescence (TSL) of  
             Lithium- and Sodium-Swept Quartz  
             Crystals - A. Halperin and S. Katz

## CATEGORY 2:

### Theory and Design of Piezoelectric Resonators

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| 2-10-1   | The Piezoelectric Survey of Strain Patterns in Thickness Shear Quartz Resonators - K.S. Van Dyke                                | 2-16-33  | Causes of Internal Friction in Crystal Resonators - E. Hafner   |
| 2-10-10  | Mathematical Theory of Vibrations of Elastic Plates - R.D. Mindlin  | 2-16-46  | Effects of External Forces on the Frequency of Vibrating Crystal Plates - C.R. Mingins, L.C. Barcus and R.W. Perry  |
| 2-10-46  | Frequency Temperature Behavior of AT-Cut Quartz Resonators - A.R. Chi   | 2-16-77  | Frequency Temperature Characteristics of Quartz Resonators Derived from the Temperature Behavior of the Elastic Constants - R. Bechmann, A.D. Ballato and T.J. Lukaszek |
| 2-10-182 | Some Phenomena in VHF Crystal Units - E. Hafner   |          |   |
| 2-11-1   | Mathematical Theory of Vibrations of Elastic Plates - R.D. Mindlin  | 2-17-28  | Measurement of Amplitude Distributions of Vibrating AT-Cut Crystals by Means of Optical Observations - G. Sauerbrey   |
| 2-11-41  | Strain Patterns in Thickness-Shear Quartz Resonators - K.S. Van Dyke  | 2-17-51  | Reactions of a Vibrating Piezoelectric Crystal Plate to Externally Applied Forces - C.R. Mingins, L.C. Barcus and R.W. Perry  |
| 2-11-78  | A Study of VHF Crystal Units - E. Hafner  | 2-17-88  | Energy Trapping and Related Studies of Multiple Electrode Filter Crystals - W. Shockley, D.R. Curran and D.J. Koneval   |
| 2-12-2   | Mathematical Theory of Vibrations of Elastic Plates and Bars - R.D. Mindlin   | 2-17-190 | Status of Quartz Crystal Research and Development - G.K. Guttwein   |
| 2-12-9   | Frequency Spectra in Quartz Resonators - C.R. Mingins, R.W. Perry and D.W. Macleod  | 2-18-93  | Energy Trapping and the Design of Single and Multi-Electrode Filter Crystals - D.R. Curran and D.J. Koneval   |
| 2-13-53  | Some New Results in the Mathematical Theory of Vibrations of Crystal Plates - R.D. Mindlin                                      | 2-18-120 | Effect of Electrode Size on Thickness Shear Vibrations of Quartz Plates - R.D. Mindlin  |
| 2-13-54  | Modes of Vibration of Quartz Crystal Resonators Investigated by Means of the Probe Method - I. Koga, H. Fukuyo and J.E. Rhodes  | 2-19-22  | The Study of Quartz Resonators by X-Ray Diffraction Topography - W.J. Spencer and K. Haruta   |
| 2-13-207 | Quartz Crystals at Low Temperatures - P.A. Simpson and A.H. Morgan  | 2-19-23  | Special X-Ray Studies of Quartz Frequency Control Units - R.A. Young, R.B. Belser, A.L. Bennett, W.H. Hicklin, J.C. Meaders and C.E. Wagner                             |
| 2-14-35  | Influence of Lattice Parameters on the Properties of Crystal Resonators - W.P. Mason  | 2-19-212 | Studies in the Mathematical Theory of Vibrations of Crystal Plates - R.D. Mindlin   |
| 2-14-53  | Measurements of the Vibrations of Quartz Plates - I. Koga, Y. Tsuzuki, S.N. Witt, Jr. and A.L. Bennett                          | 2-20-1   | X-ray Diffraction Study of Vibrational Modes - K. Haruta and W.J. Spencer   |
| 2-14-67  | Coupled Contour and Thickness Shear Vibrations - R.D. Mindlin   | 2-20-14  | Characteristics of the Electrostrictor as a Lumped Electrostrictive Active Resonator - A.A. Gundjian  |
| 2-14-89  | Effects of Initial Stress on Quartz Plates Vibrating in Thickness Modes - A.D. Ballato  | 2-20-32  | An Active Crystal Resonator - D.L. White and W.C. Wang  |
| 2-14-179 | Design of Low Frequency AT-Cut Resonators - L.A. Tyler  | 2-20-33  | The Force Sensitivity of AT-Cut Quartz Crystals - J.M. Ratajski   |
| 2-15-1   | Mathematical Theory of Vibrations of Crystal Plates - R.D. Mindlin  |          |   |
| 2-15-2   | Performance of Quartz Resonators Near the Alpha-Beta Inversion Point - J.C. King and D.B. Fraser                                |          |   |
| 2-15-22  | Frequency-Temperature Behavior of Thickness Modes of Double-Rotated Quartz Plates - R. Bechmann, A.D. Ballato and T.J. Lukaszek |          |   |



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| <p>2-20-50 Transient Reactions to Stress Changes in Vibrating Crystal Plates - C.R. Mingins, R.W. Perry and L.C. Barcus</p> <p>2-20-252 Studies in the Mathematical Theory of Vibrations of Crystal Plates - R.D. Mindlin</p> <p>2-21-3 Anharmonic, Thickness-Twist Overtones of Thickness-Shear and Flexural Vibrations of Rectangular, AT-Cut Quartz Plates - R.D. Mindlin and W.J. Spencer</p> <p>2-21-28 On the Sinusoidal Steady-State Characteristics of Multielectroded Piezoelectric Devices - E.P. EerNisse and R. Holland</p> <p>2-21-63 Investigation of Resonant Modes of Plano-convex AT-Plates - G. Sauerbrey</p> <p>2-21-72 Amplitude Distribution Determination by an X-Ray Diffraction Technique - C.E. Wagner and R.A. Young</p> <p>2-21-115 Practical Consequences of Modal Parameter Control in Crystal Resonators - G.K. Guttwein, T.J. Lukaszek and A.D. Ballato</p> <p>2-21-402 The Unwanted Responses of the Crystal Oscillator Controlled by AT-Cut Plate - H. Fukuyo, H. Yoshie and M. Nakazawa</p> <p>2-21-420 Activity Dips in AT-Cut Crystals - A.F.B. Wood and A. Seed</p> <p>2-21-436 On Activity Dips of AT-Crystals at High Level of Drive - C. Franx</p> <p>2-22-1 Electro-mechanical Vibrations in Centrosymmetric Crystals - R.D. Mindlin</p> <p>2-22-2 Parametric and Other Nonlinear Effects in Piezoelectric Resonators - E.P. EerNisse</p> <p>2-22-55 Hysteresis Effects in Quartz Resonators - D.L. Hammond, C.A. Adams and A. Benjaminson</p> <p>2-22-269 The Role of Crystal Parameters in Circuit Design - E. Hafner</p> <p>2-23-26 Analysis of Contoured Piezoelectric Resonators Vibrating in Thickness-Twist Modes - M. Onoe and K. Okada</p> <p>2-23-39 Resonance Frequencies of Monolithic Quartz Structures - A. Glowinski</p> <p>2-23-56 Electric Field Effects in Monolithic Crystal Filters - H.F. Tiersten</p> <p>2-23-128 Anomalous Vibrations in AT-Cut Plates - I. Koga</p> | <p>2-23-143 A Novel Algorithm for the Design of the Electrodes of Single-Mode AT-Cut Resonators - J.H. Sherman, Jr.</p> <p>2-24-17 Thickness-Twist Vibrations of a Quartz Strip - R.D. Mindlin</p> <p>2-24-33 Frequency-Temperature Dependence of Thickness Vibrations of Piezoelectric Plates - C.K. Hruska</p> <p>2-24-46 The Effect of Static Electric Fields on the Elastic Constants of <math>\alpha</math> - Quartz - J.A. Kusters</p> <p>2-24-55 Selected Topics in Quartz Crystal Research - C.A. Adams, G.M. Enslow, J.A. Kusters and R.W. Ward</p> <p>2-24-64 Defects and Frequency Mode Patterns in Quartz Plates - E.W. Hearn and G.H. Schwuttke</p> <p>2-25-58 Acoustical and Optical Activity in Alpha Quartz - R.D. Mindlin and R.A. Toupin</p> <p>2-25-63 Extensional, Flexural and Width-Shear Vibrations of Thin Rectangular Crystal Plates - P.C.Y. Lee</p> <p>2-25-109 Evaluation of Quartz for High Precision Resonators - B.R. Capone, A. Kahan and C.B. Sawyer</p> <p>2-25-139 The Current Dependency of Crystal Unit Resistance at Low Drive Level - S. Nonaka, T. Yuuki and K. Hara</p> <p>2-26-84 Theory of Vibrations of Plates - R.D. Mindlin</p> <p>2-26-85 An Approximate Theory for High-Frequency Vibrations of Elastic Plates - P.C.Y. Lee and Z. Nikodem</p> <p>2-26-86 Transmission-Line Analogs for Stacked Piezoelectric Crystal Devices - A.D. Ballato</p> <p>2-26-108 The Temperature Dependence of the Force Sensitivity of AT-Cut Quartz Crystals - C.R. Dauwalter</p> <p>2-26-148 Research and Development of a New Type of Crystal - The FC-Cut - G.A. Lagasse, J. Ho and M.B. Bloch</p> <p>2-27-1 Elastic Waves and Vibrations in Deformed Crystal Plates - P.C.Y. Lee, Y.S. Wang and X. Markenscoff</p> <p>2-27-7 Finite Element Calculations Relevant to AT-Cut Quartz Resonators - D.R. Cowdrey and J.R. Willis</p> <p>2-27-11 Design Equations for Bi-and Plano-Convex AT-Cut Resonators - W.D. Beaver</p> |
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| <p>2-27-20 Mass Effects on Crystal Resonators with Arbitrary Piezocoupling - A.D. Ballato and T.J. Lukaszek</p> <p>2-27-30 Rectangular AT-Cut Resonators - J.J. Royer</p> <p>2-27-35 X-Ray Topography of Quartz Resonators - C.J. Wilson</p> <p>2-28-1 Analysis of Intermodulation in Rotated Y-Cut Quartz Thickness-Shear Resonators - H.F. Tiersten</p> <p>2-28-5 Intermodulation in Thickness-Shear Resonators - R.C. Smythe</p> <p>2-28-14 Effects of Initial Bending on the Resonance Frequencies of Crystal Plates - P.C.Y. Lee, Y.S. Wang and X. Markenscoff</p> <p>2-28-19 Influence of Environment Conditions on a Quartz Resonator - M. Valdois, J.J. Gagnepain and R.J. Besson</p> <p>2-28-44 Analysis of Trapped Energy Resonators Operating in Overtones of Thickness-Shear - H.F. Tiersten</p> <p>2-28-67 High-Q BT-Cut Resonators in Flat Configuration - P.K. Schmitt</p> <p>2-28-73 Further Development on Precision Quartz Resonators - M.B. Bloch and J. Denman</p> <p>2-28-270 Bulk and Surface Acoustic Wave Excitation and Network Representation - A.D. Ballato</p> <p>2-29-1 Quartz Resonator Frequency Shifts Arising from Electrode Stress - E.P. EerNisse</p> <p>2-29-5 Relationship of Resonant Frequency of Quartz Crystal to Mass Loading - O. Lewis and C. Lu</p> <p>2-29-10 Higher-Order Temperature Coefficients of Frequency of Mass-Loaded Piezoelectric Crystal Plates - A.D. Ballato and T.J. Lukaszek</p> <p>2-29-26 Determination of the Electromechanical Coupling Factor of Quartz Bars Vibrating in Flexure or Length-Extension - J.W. Hermann</p> <p>2-29-35 Simple Exact Solutions for Thickness-Shear Mode of Vibration of a Crystal Strip - Y. Mochizuki</p> <p>2-29-42 Miniature AT-Cut Strip Resonators with Tilted Edges - M. Onoe and M. Okazaki</p> <p>2-29-49 Analysis of Nonlinear Resonance in Rotated Cut Quartz Thickness-Shear Resonators - H.F. Tiersten</p> | <p>2-29-54 Plate Constants and Dispersion Relations for Width-Length Effects in Rotated Y-Cut Quartz Plates - T.R. Meeker</p> <p>2-29-65 Waves and Vibrations in an Infinite Piezoelectric Plate - P.C.Y. Lee and S. Syngellakis</p> <p>2-29-71 Analysis of Trapped Energy Resonators Operating in Overtones of Coupled Thickness-Shear and Thickness-Twist - H.F. Tiersten</p> <p>2-29-76 Vibrational Response of a Sonar Transducer Using Piezoelectric Finite Elements - J.T. Hunt</p> <p>2-29-195 A Length-Thickness Flexure Mode Quartz Resonator - R.W. Allington</p> <p>2-30-1 Effects of Acceleration on the Resonance Frequencies of Crystal Plates - P.C.Y. Lee and K.M. Wu</p> <p>2-30-8 Calculation the Stress Compensated (SC-Cut) Quartz Resonator - E.P. EerNisse</p> <p>2-30-32 Frequency/Temperature, Activity/Temperature Anomalies in High Frequency Quartz Crystal Units - J. Birch and D.A. Weston</p> <p>2-30-40 The Relationship Between Plateback, Mass Loading and Electrode Dimensions for AT-Cut Quartz Crystal Having Rectangular Resonators Operating at Fundamental and Overtone Modes - J.F. Werner and A.J. Dyer</p> <p>2-30-54 Dimensioning Rectangular Electrodes and Arrays of Electrodes on AT-Cut Quartz Bodies - J.H. Sherman, Jr.</p> <p>2-30-65 Laser Interferometric Measurement of the Vibration Displacements of a Circular Plano-Convex AT-Cut Quartz Crystal Resonator - K. Iijima, Y. Tsuzuki, Y. Hirose and M. Akiyama</p> <p>2-30-84 Fundamental Noise Studies of Quartz Resonators - J.J. Gagnepain</p> <p>2-30-132 Temperature Characteristics of High Frequency Lithium Tantalate Plates - J. Detaint and R. Lancon</p> <p>2-30-141 The Angular Dependence of Piezoelectric Plate Frequencies and Their Temperature Coefficients - A.D. Ballato and G.J. Iafrate</p> <p>2-30-167 Analysis of Tuning Fork Type Crystal Unit and Application into Electronic Wrist Watch - S. Kanbayashi, S. Okano, K. Hirama, T. Kudama, M. Konno and Y. Tomikawa</p> |
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| <p>2-30-175 Analytical and Experimental Investigations of 32 KHz Quartz Tuning Forks - J.A. Kusters, C.A. Adams, H.E. Karrer and R.W. Ward</p> <p>2-30-184 An Approximate Theory for the High-Frequency Vibrations of Piezoelectric Crystal Plates - S. Syngellakis and P.C.Y. Lee</p> <p>2-30-191 The Vibration of a Biconvex AT-cut Plate - N. Oura, H. Fukuyo and A. Yokoyama</p> <p>2-30-196 Properties of a Flat Rectangular Quartz Resonator Vibrating in a Coupled Mode - A.E. Zumsteg and P. Suda</p> <p>2-30-202 Miniaturized Circular Disk AT-Cut Crystal Vibrator - Y. Oomura</p> <p>2-31-3 TTC's - Further Developmental Results - J.A. Kusters, C.A. Adams, H. Yoshida and J.G. Leach</p> <p>2-31-8 The Force-Frequency Effect in Doubly Rotated Quartz Resonators - A.D. Ballato, T.J. Lukaszek and E.P. EerNisse</p> <p>2-31-17 Amplitude-Frequency Behavior of Doubly Rotated Quartz Resonators - J.J. Gagnepain, J.C. Poncot and C. Pegeot</p> <p>2-31-23 Temperature Induced Frequency Changes in Electroded AT-Cut Quartz Thickness-Shear Resonators - H.F. Tiersten and B.K. Sinha</p> <p>2-31-29 The Influence of Support Configuration on the Acceleration Sensitivity of Quartz Resonator Plates - P.C.Y. Lee and K.M. Wu</p> <p>2-31-35 X1 and X3 Flexure, Face-Shear, Extension, Thickness-Shear, and Thickness-Twist Modes in Rectangular Rotated Y-Cut Quartz Plates - T.R. Meeker</p> <p>2-31-44 An Analysis of Overtone Modes in Contoured Crystal Resonators - H.F. Tiersten and R.C. Smythe</p> <p>2-31-48 4 MHz AT-Cut Strip Resonator for Wrist Watch - M. Onoe, K. Kamada, M. Okazaki, F. Tajika and N. Manabe</p> <p>2-31-55 DT-Cut Torsional Resonators - J.W. Hermann</p> <p>2-31-147 A New "Electrodeless" Resonator Design - R.J. Besson</p> <p>2-32-108 Thickness-Shear, Thickness-Twist, and Flexural Vibrations of Rectangular AT-Cut Quartz Plates with Patch Electrodes - P.C.Y. Lee, C. Zee and C.A. Brebbia</p> | <p>2-32-120 A New Method to Analyse Vibrations of Resonators by the Combination of Plate Equations and Finite Element Method - Y. Mochizuki</p> <p>2-32-134 Finite Element Analysis of AT-Cut Crystals - D.C.L. Vangheluwe</p> <p>2-32-142 Discrete Element Modeling of AT-Quartz Devices - L.N. Dworsky</p> <p>2-32-150 Temperature Derivatives of the Fundamental Elastic Constants of Quartz - B.K. Sinha and H.F. Tiersten</p> <p>2-32-155 Temperature Induced Frequency Changes in Electroded Doubly-Rotated Quartz Thickness Mode Resonators - H.F. Tiersten and B.K. Sinha</p> <p>2-32-162 A New NonLinear Analysis Method and Its Application to Quartz Crystal Resonator Problems - J.H. Balbi, J.A. Duffaud and R.J. Besson</p> <p>2-32-169 Analytical Calculation of Initial Stress Effects on Anisotropic Crystals: Application to Quartz Resonators - D. Janiaud, L. Nissim and J.J. Gagnepain</p> <p>2-32-180 Static and Dynamic Frequency-Temperature Behavior of Singly and Doubly Rotated, Oven Controlled Quartz Resonators - A.D. Ballato and J.R. Vig</p> <p>2-32-202 Holographic Displacement Amplitude Measurements of Four Anharmonic AT Modes - L.C. Barcus</p> <p>2-32-207 Some Observations Using Scanning Electron Microscope for Studying The Ultrasonic Vibrations of Quartz Crystals - H. Bahadur, A. Hepworth, V. Lall and R. Parshad</p> <p>2-32-255 Rotated X-Cut Quartz Resonators for High-Temperature Applications - E.P. EerNisse</p> <p>2-32-260 Energy Trapping of Coupled Modes in Rectangular AT-Cut Resonators - A.E. Zumsteg, P. Suda and W. Zingg</p> <p>2-32-267 A 4.19 MHz Beveled Miniature Rectangular AT-Cut Quartz Resonator - S. Yamashita, N. Echigo, Y. Kawamura, A. Watanabe and K. Kubota</p> <p>2-32-277 +5° X Micro Quartz Resonator by Lithographic Process - K. Oguchi and E. Momosaki</p> <p>2-33-228 Temperature Induced Frequency Changes in Electroded Contoured Quartz Crystal Resonators - B.K. Sinha and H.F. Tiersten</p> |
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| <p>2-33-235 Frequency Response of a Quartz Oscillator to Temperature Fluctuation - Y. Teramachi, M. Horie, H. Kataoka and T. Musha</p>   | <p>2-34-58 A New Equivalent Circuit for Piezoelectric Ceramic Disk Resonators - M. Toki, Y. Tsuzuki and O. Kawano</p>                          |
| <p>2-33-239 Dynamic Thermal Behavior of Quartz Resonators - G. Theobald, G. Marianneau, R. Pretot and J.J. Gagnepain</p>   | <p>2-34-131 New Frequency Temperature Characteristics of Miniaturized GT-Cut Quartz Resonators - H. Kawashima, H. Sato and O. Ochiai</p>       |
| <p>2-33-247 New Quartz Tuning Fork with Very Low Temperature Coefficient - E. Momosaki, S. Kogure, M. Inoue and T. Sonoda</p>  | <p>2-34-140 Frequency Temperature Behavior of Miniaturized Circular Disk-AT-Cut Crystal Resonator - Y. Oomura</p>                              |
| <p>2-33-255 A New Quartz Crystal Cut for Contour Mode Resonators - J.W. Hermann and C. Bourgeois</p>   | <p>2-34-152 Improving Frequency-Temperature Characteristics of Grooved AT-Cut Plates - M. Nakazawa</p>   |
| <p>2-33-263 Three-Dimensional Variational Analysis of Small Crystal Resonators - R.F. Milsom</p>   | <p>2-34-160 New Type Twin Mode Resonator - S. Kogure, E. Momosaki and T. Sonoda</p>  |
| <p>2-33-271 Frequency Temperature Characteristics of Rectangular AT-Cut Quartz Plates - T. Kato and H. Ueda</p>  | <p>2-34-187 Fundamental Mode SC-Cut Resonators - R.L. Filler and J.R. Vig</p>  |
| <p>2-33-277 New Frequency-Temperature Characteristics of 4.19 MHz Beveled Rectangular AT-Cut Quartz Resonator - S. Yamashita, S. Motte, K. Takahashi, N. Echigo, A. Watanabe and K. Kubota</p> | <p>2-34-384 Temperature Induced Frequency Changes in Electroded AT-Cut Quartz Trapped Energy Resonators - D.S. Stevens and H.F. Tiersten</p>   |
| <p>2-33-286 Extension, Flexure, and Shear Modes in Rotated X-Cut Quartz Rectangular Bars - T.R. Meeker</p>   | <p>2-34-393 Transient Thermally Induced Frequency Excursions in Doubly-Rotated Quartz Thickness Mode Resonators - B.K. Sinha</p>               |
| <p>2-33-293 Nonlinear Vibrations of Quartz Rods - H.F. Tiersten and A.D. Ballato</p>   | <p>2-34-403 Nonlinear Effect of Initial Stresses in Doubly-Rotated Crystal Resonator Plates - P.C.Y. Lee and K.M. Wu</p>                       |
| <p>2-33-300 Temperature Dependence of the Force Frequency Effect for the Rotated X-Cut - E.P. EerNisse</p>   | <p>2-34-412 The Frequency and Motional Capacitance of Partial Contoured Crystal Resonators - D.C.L. Vangheluwe</p>                             |
| <p>2-33-306 Low "g" Sensitivity Crystal Units and Their Testing - A.W. Warner, Jr., B. Goldfrank, M.P. Meirs and M. Rosenfeld</p>  | <p>2-34-419 Decoupled Families of Contour Modes of Planar Thin Plates - C. Bourgeois</p>   |
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| <p>2-33-322 Resonators Compensated for Acceleration Fields - A.D. Ballato</p>  | <p>2-34-431 Subtle Effects in High Stability Vibrators - A.D. Ballato, T.J. Lukaszek and G.J. Iafrate</p>                                      |
| <p>2-33-337 Design of a Bulk Wave Quartz Resonator Insensitive to Acceleration - R.J. Besson, J.J. Gagnepain, D. Janiaud and M. Valdois</p>  | <p>2-35-14 Nonlinear Properties of Quartz Crystal and Quartz Resonators: A Review - J.J. Gagnepain</p>   |
| <p>2-33-346 A Comparison of the Effects of Bending Moments on the Vibrations of AT and SC (or TTC) Cuts of Quartz - E.D. Fletcher and A.J. Douglas</p>   | <p>2-35-31 The Effect of Vibration on Frequency Standards and Clocks - R.L. Filler</p>   |
| <p>2-33-444 Bulk Acoustic Resonators for Microwave Frequencies - R.A. Moore, F.W. Hopwood, T. Haynes and B.R. McAvoy</p>   | <p>2-35-71 Force and Acceleration Frequency Effects in Grooved and Ring Supported Resonators - M. Nakazawa, T.J. Lukaszek and A.D. Ballato</p> |
|  | <p>2-35-92 Update of SC-Cut Crystal Resonator Technology - B. Goldfrank, J. Ho and A.W. Warner, Jr.</p>  |

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| 2-35-99  | Design of High Performance SC Resonators - R.W. Ward   | 2-35-340 | Quartz Resonator Thermal Transient Due To Crystal Support - D. Janiaud, M. Valdois, R.J. Besson and J.J. Gagnepain  |
| 2-35-110 | The Acceleration and Warmup Characteristics of Four-Point-Mounted SC and AT-Cut Resonators - R.L. Filler and J.R. Vig                                | 2-35-365 | Direct Frequency Crystal Oscillators - L. Bidart and J. Chauvin   |
| 2-35-122 | Indirect Amplitude Frequency Effect in Resonators Working on Two Frequencies - J.P. Valentin, C.P. Guerin and R.J. Besson                            | 2-36-3   | Third Overtone Quartz Resonator - R.D. Mindlin  |
| 2-35-130 | Quartz Tuning Fork Crystal Using Overtone Flexure Modes - S.S. Chuang  | 2-36-22  | The Design of Partially Controlled Quartz Crystal Resonators - R.C. Peach   |
| 2-35-144 | A Miniature Quartz Resonator Vibrating at 1 MHz - R.J. Dinger  | 2-36-29  | Effect of Transverse Force on the Thickness-Shear Resonance Frequencies in Rectangular, Doubly-Rotated Crystal Plates - P.C.Y. Lee and C.S. Lam             |
| 2-35-149 | Investigation of Spurious Modes of Convex DT-Cut Quartz Crystal Resonators - T. Adachi, Y. Tsuzuki and C. Takeuchi                                   | 2-36-37  | An Analysis of Contoured SC-Cut Quartz Crystal Resonators - H.F. Tiersten and D.S. Stevens  |
| 2-35-157 | The Edge Mode Resonator - D.C.L. Vangheluwe and E.D. Fletcher  | 2-36-46  | Temperature Induced Frequency Changes in Electroded Contoured SC-Cut Quartz Crystal Resonators - D.S. Stevens and H.F. Tiersten                             |
| 2-35-166 | 4.19 MHz Cylindrical AT-Cut Miniature Resonator - S. Okano, T. Kudama, K. Yamazaki and H. Kotake   | 2-36-133 | Thermal Frequency Behavior in Contoured Quartz Crystal Plates Induced by Direct Irradiation of Laser Beam - N. Oura, N. Kuramochi, J. Nakamura and T. Ogawa |
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| 2-35-187 | Simple Model For an AT-Cut Rectangular Quartz Plate - J.H. Balbi and M.I. Dulmet   | 2-36-170 | Turnover Temperatures for Doubly Rotated Quartz - A. Kahan  |
| 2-35-193 | Stresses in Rectangular Cantilever Crystal Plates Under Transverse Loading - P.C.Y. Lee and C.S. Lam   | 2-36-181 | SC-Cut Resonators for Temperature Compensated Oscillators - J.R. Vig, R.L. Filler and J.A. Kosinski   |
| 2-35-205 | An Analysis of SC-Cut Quartz Trapped Energy Resonators with Rectangular Electrodes - D.S. Stevens and H.F. Tiersten                                  | 2-36-200 | Amplitude Frequency Effect of SC-Cut Quartz Trapped Energy Resonators - R. Bourquin, D. Nassour and D. Hauden   |
| 2-35-213 | Stress Compensated Orientations for Thickness-Shear Quartz Resonators - B.K. Sinha   | 2-36-215 | The Effect of Blank Geometry on the Acceleration-Sensitivity of AT- & SC-Cut Quartz Resonators - R.L. Filler, J.A. Kosinski and J.R. Vig                    |
| 2-35-222 | Extensional Vibrations of Rectangular Crystal Plates - P.C.Y. Lee, M. Nakazawa and J.P. Hou  | 2-36-513 | Improved Ring-Supported Resonators - M. Nakazawa, H. Ito, T.J. Lukaszek and A.D. Ballato  |
| 2-35-230 | Coupled Thickness-Shear and Thickness-Twist Resonances in Unelectroded Rectangular and Circular AT-Cut Quartz Plates - H.F. Tiersten and R.C. Smythe | 2-36-529 | Unwanted Responses in Quartz Low Frequency X-Cut Bars - J.F. Werner, H.W. Edwards and M. Smith  |
| 2-35-250 | Unwanted Modes in 5 X-Cut Crystal Units - J.J. Royer   | 2-36-549 | Development and Technology of Piezoelectric Bulk Wave Resonators and Transducers - T.R. Meeker  |
| 2-35-335 | Quartz Crystal Oscillator at Cryogenic Temperature - B. Komiyama   | 2-37-194 | The Stress Coefficient of Frequency of Quartz Plate Resonators - M. Mizan and A.D. Ballato  |

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| <p>2-39-361 An Air-Gap Type Piezoelectric Composite Thin Film Resonator - H. Satoh, Y. Ebata, H. Suzuki and C. Narahara</p> <p>2-39-372 Highly Stable, Ovenized Bulk Shear Mode Resonators - B.R. McAvoy, S.V. Krishnaswamy, H.L. Salvo, Jr. and R.A. Moore</p> <p>2-39-37 A Novel Miniature ZT-Cut Resonator - J.W. Hermann</p> <p>2-39-381 Characteristics of a Quartz Crystal Tuning Fork with Shortened Arm Length for High Frequencies - M. Okazaki, H. Tohma and Y. Tomikawa</p> <p>2-39-386 Analysis of Trapped Energy Resonators with Tabs - H. Sekimoto, H. Nakata and M. Miura</p> <p>2-39-392 A Variational Method for the Design of Trapped Energy Resonators - R.C. Peach</p> <p>2-39-400 Further Results on the Contour Dependence of the Frequency-Temperature Characteristic of SC-Cut Resonators - J.A. Kosinski</p> <p>2-39-405 Mechanical Couplings Involving Discontinuities of the Frequency-Temperature Curves of Contoured Quartz Resonators - R. Bourquin, B. Dulmet and G. Genestler</p> <p>2-39-415 Frequency-Temperature Behavior of Flexural and Thickness-Shear Vibrations of Rectangular Rotated Y-Cut Quartz Plates - Y.K. Yong and P.C.Y. Lee</p> <p>2-39-427 A note on "Ballato's Angle Increment" - J.H. Sherman, Jr.</p> <p>2-39-431 Vibrations of Piezoelectric Discs Under Initial Stresses - M.C. Dokmeci</p> <p>2-39-436 An Analysis of Doubly-Rotated Contoured Quartz Crystal Resonators - D.S. Stevens and H.F. Tiersten</p> <p>2-39-448 Generalized Equation for the Force-Frequency Characteristics of Circular Quartz Plates with Three-Point Support and its Application to Supporting of an SC-Cut Plate - N. Oura, N. Kuramochi, Y. Miyazaki, M. Yamashina and S. Suzuki</p> <p>2-39-453 Vibrations of Doubly-Rotated Piezoelectric Crystal Strip with a Pair of Electrode-Plated, Traction-Free Edges - P.C.Y. Lee and J.P. Hou</p> <p>2-39-462 Simple Thickness Plate Modes Driven by Lateral Fields - A.D. Ballato, E.R. Hatch, M. Mizan, T.J. Lukaszek and R. Tilton</p> | <p>2-39-473 Lateral Field Resonators - A.W. Warner, Jr. and B. Goldfrank</p> <p>2-40-145 Dynamic Permittivities and Resistivities of the Equivalent Network Representing Plate Resonators - A.D. Ballato, E.R. Hatch, M. Mizan and T.J. Lukaszek</p> <p>2-40-152 Initial Stress Field and Resonance Frequencies of Incremental Vibrations in Crystal Resonators by Finite Element Method - P.C.Y. Lee and M.S.H. Tang</p> <p>2-40-161 A Transmission Line Matric Model for AT Quartz Thickness Shear Devices - L.N. Dworsky</p> <p>2-40-168 Nonlinear Electroelastic Equations of Wave Propagation and Vibrations in Quartz Bars - M.C. Dokmeci</p> <p>2-40-179 Three-Dimensional Finite Element Solution of the Lagrangean Equations for the Frequency-Temperature Behavior of Y-Cut and NT-Cut Bars - Y.K. Yong</p> <p>2-40-187 Suppression of Anharmonic Spurious Modes by Modified Electrode Design Using Charge Cancellation - H. Sekimoto, T. Ihara, H. Nakata and M. Miura</p> <p>2-40-193 Variational Analysis of GT-Cut Quartz Crystal Resonators with the Supporting Portions at the Ends - H. Kawashima</p> <p>2-40-201 An Overtone-Mode Assigned AT-Cut Crystal Resonator - K. Hirama, T. Shoji and Y. Tanaka</p> <p>2-40-206 Overtone Response of Composite Bulk Acoustic Resonators - J. Rosenbaum, H.L. Salvo, Jr. and S.V. Krishnaswamy</p> <p>2-40-262 An Analysis of the Acceleration Sensitivity of ST-Cut Quartz Surface Wave Resonators Supported Along the Edges - D.V. Shick and H.F. Tiersten</p> <p>2-40-269 Low Loss, Highly Stable Saw Devices on Quartz - T.N. Oliver, D.E. Bower and J. Dowsett</p> <p>2-40-285 Acoustic Charge Transport Principles and Performance - M.J. Hoskins, M.J. Brophy, J.M. Dallesasse, M.J. Miller and J.W. Peterson</p> <p>2-41-236 Studies of Quartz Resonators by Stroboscopic Topography - A. Zarka, B. Capelle, J. Detaint and J. Schwartzel</p> <p>2-41-266 Nonlinear Constants and Their Significance - J.J. Gagnepain</p> |
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## CATEGORY 2 (Cont'd):

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| <p>2-41-277 Acceleration Effect on the Thickness Vibrations of Doubly Rotated Crystal Resonators - P.C.Y. Lee and M.S.H. Tang</p> <p>2-41-282 An Analysis of the Normal Acceleration Sensitivity of ST-Cut Quartz Surface Wave Resonators Rigidly Supported Along the Edges - H.F. Tiersten and D.V. Shick</p> <p>2-41-289 Force Sensitivity of Trapped Energy Vibrations in a Countoured Resonator - R. Bourquin and B. Dulmet</p> <p>2-41-295 AT Quartz Strip Resonators - L.N. Dworsky</p> <p>2-41-303 A Lagrangean, High Frequency Plate Element for the Static Temperature Behavior of Low Frequency Quartz Resonators - Y.K. Yong</p> <p>2-41-311 An Approximate Expression for the Motional Capacitance of a Lateral Field Resonator - R.C. Smythe and H.F. Tiersten</p> <p>2-41-314 Energy Trapping in Plan and Corrugated Resonators: Application to Quartz and Berlinite - J. Detaint, J. Schwartzel, C. Joly and E. Philippot</p> <p>2-41-325 Lateral- and Thickness-Field Coupling in Zincblende Structures - A.D. Ballato, T.J. Lukaszek, M. Mizan and J.A. Kosinski</p> <p>2-41-391 Analysis and Design of the Piezoelectric Ceramic Resonator Oscillators - S. Fujishima, K. Togawa and S. Ohta</p> | <p>2-42-65 A Variational Analysis of a New Shape Face Shear Mode Quartz Crystal Resonator Formed by an Etching Method - H. Kawashima, M. Matsuyama and M. Nakazato</p> <p>2-42-73 Chemically-Milled UHF SC-Cut Resonators - R.C. Smythe and R. Angove</p> |
| <p>2-42-6 Mindlin's Elastoelectrodynamics Problem - A.D. Ballato</p> <p>2-42-14 Acceleration Insensitivity of Thickness Frequencies of Doubly Rotated Quartz Disks - P.C.Y. Lee and M.S.H. Tang</p> <p>2-42-19 Linear Model of the Contoured Resonators - J. Detaint, H. Carru, J. Schwartzel, B. Capelle and A. Zarka</p> <p>2-42-29 Vibrations of Z-Cut Resonator-Structure by Finite Element Analysis - Y.K. Yong, P.C.Y. Lee and S.S. Chuang</p> <p>2-42-38 Rigorous Two-Dimensional Equations for the Analysis of Contoured Crystal Resonators - R.C. Peach</p> <p>2-42-45 Vibration Analysis of Coupled Flexural Torsional Mode Tuning Fork Type Quartz Crystal Resonator - H. Kawashima</p>   |   |



### CATEGORY 3:

#### Radiation Effects on Resonators and Oscillators

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| 3-12-101 | Pile Irradiation of Quartz Crystal Units - F.E. Graham and A.F. Donovan   | 3-33-62  | Radiation Effects in Berlinite - L.E. Halliburton, L.A. Kappers, A.F. Armington and J.J. Larkin  |
| 3-13-37  | Defects of the Quartz System Produced by Neutron Irradiation - R. Weeks   | 3-33-98  | Point Defects and Radiation Damage Processes in a-Quartz - D.L. Griscom  |
| 3-14-138 | Nuclear Radiation Effects in Quartz Crystals - J.M. Stanley   | 3-33-118 | Radiation-Induced Frequency Transients In AT, BT and SC-Cut Quartz Resonators - D.R. Koehler   |
| 3-16-7   | Effects of Reactor Irradiation on Thickness Shear Crystal Resonator - J.C. King and D.B. Fraser   | 3-33-122 | Radiation Effects in Swept Premium-Q Quartz Material, Resonators and Oscillators - H.G. Lipson, F.K. Euler and P.A. Ligor  |
| 3-17-127 | Aging Characteristics of Quartz Resonators with Comments on the Effects of Radiation - R.B. Belser and W.H. Hicklin   | 3-33-134 | Radiation-Induced Mobility of Interstitial Ions in Synthetic Quartz - J.J. Martin, S.P. Doherty, L.E. Halliburton, M.E. Markes, N. Koumvakalis, W.A. Sibley, R.N. Brown and A.F. Armington |
| 3-20-82  | Radiation Effects in Frequency Control Devices - J.M. Stanley   | 3-34-72  | Radiation Effects in Quartz Oscillators, Resonators and Materials - F.K. Euler, H.G. Lipson and P.A. Ligor   |
| 3-23-178 | Effects of Gamma Irradiation on Frequency Stability of 5th Overtone Crystal Oscillators - C.A. Berg and J.R. Erickson   | 3-35-322 | Radiation-Induced Conductivity and High Temperature Q Changes in Quartz Resonators - D.R. Koehler  |
| 3-27-113 | Rapid Annealing of Frequency Change in High Frequency Crystal Resonators Following Pulsed X-Irradiation at Room Temperature - J.C. King and H.H. Sander           | 3-37-130 | Radiation Induced Transient Acoustic Loss in Quartz Crystals - D.R. Koehler and J.J. Martin  |
| 3-27-120 | Crystal Controlled Oscillators for Radiation Environments - R.E. Paradysz and W.L. Smith  | 3-38-32  | Effect of Irradiation and Annealing on the Electrical Conductivity of Quartz Crystals - E.R. Green, J. Toulouse, J. Wacks and A.S. Nowick  |
| 3-27-124 | Calculation of Transient Thermal Imbalance Within Crystal Units Following Exposure to Pulse Irradiation - E.F. Hartman and J.C. King                              | 3-38-55  | An X-Ray Irradiation System for Total-Dose Testing of Quartz Resonators - L.J. Palkuti and Q.T. Troung   |
| 3-27-128 | Transient X-Ray Induced Conductivity in Single Crystal Quartz - R.C. Hughes   | 3-38-63  | Results from Gamma Ray and Proton Beam Radiation Testing of Quartz Resonators - J.R. Norton, J.M. Cloeren and J.J. Suter   |
| 3-27-136 | Hydrogen Diffusion in Quartz: The Kinetics of a One-Dimensional Process - A. Sosin  | 3-39-259 | Radiation Effects in Quartz: Low Doses and Defect Production Mechanisms - L.E. Halliburton, C.Y. Chen and S.D. Tapp  |
| 3-27-139 | Effects of a Co-60 Gamma-Ray Irradiation on the Optical Properties of Natural and Synthetic Quartz from 85 to 300 K. - P.L. Mattern, K. Lengweiller and P.W. Levy | 3-39-266 | Radiation Effects in the Acoustic Loss Spectra of AT-Cut Quartz Crystals - J.J. Martin, H.B. Hwang and H. Bahadur  |
| 3-27-153 | A Review of Impurity Atom Defects in -Quartz as Observed by Electron Paramagnetic Resonance - J.A. Weill  | 3-40-96  | Study of Irradiation Effects in Quartz Crystal Using Low-Temperature Dielectric Relaxation - S. Ling and A.S. Nowick   |
| 3-28-143 | The Effect of Gamma Irradiation on the Temperature-Frequency Characteristic of AT-Cut Quartz - H.J. Benedikter, J.H. Sherman, Jr. and R.D. Gillespie III          |          |  |

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- 3-40-127 Evaluation of Mechanisms for Low-Dose Frequency Shifts in Crystal Oscillators - T.M. Flanagan, R.E. Leadon and D.L. Shannon
- 3-40-134 Low and Medium Dose Radiation Sensitivity of Quartz Crystal Resonators with Different AL-Impurity Content - J.J. Suter and R.H. Maurer
- 3-41-216 Radiation Effects in Vacuum-Swept Quartz - A. Kahan, F.K. Euler, H.G. Lipson, C.Y. Chen and L.E. Halliburton

#### CATEGORY 4:

#### Resonator Processing Techniques and Aging

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| 4-10-122 | Aging Study of Quartz Crystal Resonators - R.B. Belser and W.H. Hicklin   | 4-13-71  | Aging Studies on Crystal Units - R.B. Belser and W.H. Hicklin  |
| 4-10-190 | Crystal Unit Design for Use in a Ground Station Frequency Standard - A.W. Warner, Jr.   | 4-13-109 | Aging Characteristics of Quartz Crystal Units - P.E. Mulvihill   |
| 4-10-513 | Tests on Hermetic Enclosures of Piezoelectric Quartz Crystals - B.W. Schumacher   | 4-13-406 | Phase Stable Crystal Units - L.A. Dick   |
| 4-10-524 | Production Procedures for VHF Crystals - R.D. Cortwright  | 4-13-423 | Glass Enclosed Moderate Precision Crystal Units - E.M. Shideler and D.L. Hammond   |
| 4-10-540 | Manufacturing Problems Connected with High Precision Crystals - J.M. Wolfskill  | 4-13-430 | Glass Enclosed Minaturized Crystal Units - H. Long   |
| 4-10-569 | Manufacturing Problems Connected with Miniaturized Crystals - G.K. Bistline, Jr.  | 4-13-445 | High Temperature Crystal Units Employing Thermocompression Techniques - J.P. Griffin   |
| 4-10-573 | Automatic X-Ray Sorter for Crystal Blanks - L.V. Wise   | 4-13-498 | Development and Production of Glass Enclosed Quartz Crystals - R.S. Sennett, D.M. Eisen and L.R. Clark                         |
| 4-11-157 | Aging Study of Quartz Resonators - R.B. Belser and W.H. Hicklin   | 4-13-512 | Fabrication of High Precision 5 Mc Crystal Units - J.M. Wolfskill and R.T. Schlaudecker  |
| 4-11-189 | High Temperature AT-Cut Crystal Units - C.W. Mann   | 4-13-529 | Results of Pilot Runs in a Mechanized Crystal Plant - A. Mann  |
| 4-11-214 | High Temperature, Low Frequency Crystal Units - J.M. Wolfskill  | 4-13-535 | Production of VHF Crystal Units - G.F. Fisher  |
| 4-11-240 | High Precision Crystal Units - L.A. Dick  | 4-14-68  | Parallel Field Excitation of Thickness Modes of Quartz Plates - R. Bechmann  |
| 4-11-256 | Stability of Quartz Resonators at Very Low Temperatures - F.P. Phelps   | 4-14-115 | The Aging of Aluminum Plated 16.5 Mc AT-cut Quartz Resonators - R.B. Belser and W.H. Hicklin                                   |
| 4-11-277 | Fundamental Studies on an Improved Crystal-Controlled Frequency Standard - M.D. Fagen and W.L. Smith                                | 4-14-154 | Development of Precision Crystal Units for Satellite Use - J.M. Wolfskill and R.T. Schlaudecker                                |
| 4-12-37  | Effects of Plating to Frequency on the Stability of Quartz Resonators - R.B. Belser and W.H. Hicklin                                | 4-14-397 | Tuning Forks as Circuit Elements - M. Pleasure   |
| 4-12-162 | Research at NBS Boulder Laboratories on Quartz Crystal Resonators and Oscillators at Low Temperatures - F.P. Phelps and A.H. Morgan | 4-15-49  | Temperature Compensation of Piezoelectric Resonators by Mechanical Stress - E.A. Gerber and M.H. Miles                         |
| 4-12-211 | Ruggedization of Low Frequency Crystal Units - J.M. Wolfskill   | 4-15-66  | Stability Studies of Quartz Crystals for Satellites - R.B. Belser and W.H. Hicklin   |
| 4-12-241 | Phase Stable Quartz Crystal Units - L.A. Dick   | 4-15-109 | Micro-Module and Ultra-Miniaturized Crystal Units - R.R. Bigler  |
| 4-12-260 | Moderate Precision Crystal Units - D.L. Hammond   | 4-15-113 | Precision Glass Enclosed Crystal Units - E.M. Shideler and P.E. Bryan  |
| 4-12-281 | Low Frequency XY'Flexure Crystal Units - A.S. Matistic  | 4-15-125 | Precision Quartz Resonators - D.L. Hammond   |
| 4-12-296 | Design Data for HF AT Crystal Units - L.A. Tyler and C. Rutkowski   | 4-16-110 | Aging of Quartz Resonators at Fundamental and Overtone Modes with Comments on Radiation Effects - R.B. Belser and W.H. Hicklin |
| 4-12-316 | Design Parameters for VHF Crystal Units - D. McKeown  |          |  |

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| 4-16-146 | Recent Developments in Miniaturized Glass Enclosed Crystal Holders - G.K. Bistline, Jr.                            | 4-18-597 | High-Q, BT-Cut, Quartz Resonator Units - A. Seed   |
| 4-16-156 | Improved Ceramic Envelopes for Micromodule Crystal Units - J.H. Sherman, Jr.                                       | 4-19-78  | Miniature Single Sideband Crystal Units - J.M. Wolfskill and R.A. Spurlin  |
| 4-16-169 | Temperature Compensated Quartz Crystal Units - R.J. Munn   | 4-19-105 | Passive Temperature Compensation of Quartz Crystals for Oscillator Applications - S.B. Boor, W.H. Horton and R.B. Angove               |
| 4-17-4   | Studies on High Precision Resonators - R.A. Sykes, W.L. Smith and W.J. Spencer                                     | 4-19-125 | Seal Test Methods and Evaluation of Enclosures for Crystal Units - R.L. Reynolds and R.J. Byrne  |
| 4-17-215 | Precision Crystal Units - D.L. Hammond, C.A. Adams and L.S. Cutler   | 4-19-137 | Application of Leak Theory to Crystal Testing - J.W. Marr and J.H. Sherman, Jr.  |
| 4-17-233 | High Q Crystal Units - W. Ianouchevsky   | 4-20-161 | Comments on Unwanted Responses in VHF Crystals - E.A. Gerber   |
| 4-17-248 | Use of Parallel-Field Excitation in the Design of Quartz Crystal Units - A.W. Warner, Jr.                          | 4-20-167 | Discussion of 3.0 and 5.0 MHz, SSB Crystals Precise and Uniform - R.F. Woolley and G.A. Lagasse  |
| 4-17-267 | Crystal Units for Single Sideband Application - P.E. Bryan and E.M. Shideler                                       | 4-20-180 | Aging of Aluminum Plated 3-MC Semi-Precision Resonators - R.B. Belser and W.H. Hicklin   |
| 4-17-272 | Design Equations for Plano-Convex AT-Filter Crystals - W.G. Stoddard   | 4-20-192 | Aging Characteristics of Quartz Crystal Resonators - J.H. Armstrong, P.R. Blomster and J.L. Hokanson                                   |
| 4-17-283 | Development Status of Quartz Micromodule Crystal Units - P.J. Staelens   | 4-20-208 | Quartz Crystal Life Test Data - F. Wolf and G.K. Bistline, Jr.   |
| 4-17-302 | Improvements in Technique for Thermo-Compressing Mounting Wires to Quartz Crystal Plates - J.P. Griffin            | 4-20-219 | Five Megacycle Fifth Overtone Resonators Operating Near the Inflection Temperature - J.G. Leach  |
| 4-17-325 | Problems Associated with Precision Quartz Resonators - W.J. Spencer  | 4-20-234 | Microminiature Cold Weld Crystal Units - A. Seed   |
| 4-18-129 | Aging Analysis of AT-Cut Quartz Resonators of Natural, Cultured and Swept Varieties - R.B. Belser and W.H. Hicklin | 4-20-530 | Low Power Crystal Ovens - M.B. Bloch, J. Ho and I. Math  |
| 4-18-166 | Design and Performance of a New Series of Cold Welded Crystal Unit Enclosures - R.J. Byrne and R.L. Reynolds       | 4-21-200 | The Transient Thermal Characteristics of Quartz Resonators and Their Relation to Temperature-Frequency Curve Distortion - L.E. Schnurr |
| 4-18-181 | A New Design for Microminiature Crystals - W.G. Stoddard   | 4-21-211 | AT-Cut Resonators with Annular Electrodes - R.B. Belser and W.H. Hicklin   |
| 4-18-193 | Glass Enclosed Crystal Units for Temperature Compensated Oscillators - G.K. Bistline, Jr. and D.B. Jacoby          | 4-21-224 | SSB Quartz Crystal Units Utilizing Coldweld Enclosures and High Temperature Bakeout Techniques - F.R. Brandt and G.E. Ritter           |
| 4-18-204 | New Developments in Glass Enclosed Crystal Units - D.M. Eisen  | 4-21-244 | Increased Crystal Units Resistance at Oscillator Noise Levels - M. Bernstein   |
| 4-18-217 | Reliability of Quartz Crystal Units - J.M. Stanley and P.E. Mulvihill  | 4-22-67  | Design Considerations for Oscillator Crystals - G.K. Guttwein, A.D. Ballato and T.J. Lukaszek  |
| 4-18-426 | On the Control of the Temperature Coefficient of Frequency of AT-Crystals - C. Franx                               |          |  |

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| 4-22-89  | Advancements in Production of 5-MHz Fifth Overtone High Precision Crystal Units - J.M. Wolfskill                           | 4-27-73  | The Molecular Nature of Absorption on Silica Surfaces - M.L. Hair   |
| 4-22-118 | Kold-Seal Thermal Compression Bonded Crystals - J. Denman, G.A. Lagasse, M.B. Bloch and J. Ho                              | 4-27-79  | Clean Surface Technology - M.L. White   |
| 4-22-136 | Quartz Crystal Aging - E. Hafner and R.S. Blewer   | 4-27-89  | Thin Film Metallization of Oxides - D.M. Mattox   |
| 4-22-155 | Improvements in Sealing HC-26/U and HC-27/U Glass Holders - G. Giber   | 4-27-98  | Surface Preparation and Characterization Techniques for Quartz Resonators - J.R. Vig, H. Wasshausen, C.F. Cook, Jr., M. Katz and E. Hafner                |
| 4-22-226 | Micro Resonators in Electronics - J.H. Staudte   | 4-28-85  | The Structure and Properties of Thin Metal Films - D.M. Hoffman   |
| 4-23-132 | Comparison of Aging Performance of 5-MHz Resonators Plated with Various Electrode Metals - R.B. Belser and W.H. Hicklin    | 4-28-89  | Methods of Cleaning Contaminants from Quartz Surfaces During Resonator Fabrication - R.K. Hart, W.H. Hicklin and L.A. Phillips                            |
| 4-23-163 | Laser Machining Thin Film Electrode Arrays on Quartz Crystal Substrates - J.L. Hokanson                                    | 4-28-96  | Surface Studies for Quartz Resonators - J.R. Vig, C.F. Cook, Jr., K. Schwidtal, J.W. LeBus and E. Hafner  |
| 4-24-111 | Auger Spectroscopy in Studies of the Aging Factors of Quartz Crystal Resonators - G.W. Simmons, W.H. Hicklin and R.K. Hart | 4-28-109 | Stabilization of Resonance Frequencies in Piezoelectric Ceramic Resonators Against Sudden Temperature Change - M. Takahashi, F. Yamauchi and S. Takahashi |
| 4-24-117 | 5 MHz BT Cut Resonators - J.G. Leach   | 4-29-128 | A Survey of Ion Beam Milling Techniques for Piezoelectric Device Fabrication - R.N. Castellano and J.L. Hokanson  |
| 4-24-126 | Mode Control and Related Studies of VHF Quartz Filter Crystal - T.J. Lukaszek  | 4-29-187 | 32 KHz Quartz Crystal Unit for High Precision Wrist Watch - J. Engdahl and H. Matthey   |
| 4-24-141 | Low Aging Crystal Units for Use in Temperature Compensated Oscillators - J.F. Silver and L.A. Dick                         | 4-29-202 | A New Ceramic Flat Pack for Quartz Resonators - P.D. Wilcox, G.S. Snow, E. Hafner and J.R. Vig  |
| 4-24-148 | Dynamic Temperature Behavior of Quartz Crystal Units - W.H. Hicklin  | 4-29-220 | Further Results on UV Cleaning and Ni Electrobonding - J.R. Vig, J.W. LeBus and R.L. Filler   |
| 4-24-157 | The Direct Temperature Control of Quartz Crystals in Evacuated Enclosures - F.G. Tinta, A.S. Matistic and G.A. Lagasse     | 4-29-230 | On the Origin of the 'Second Level of Drive' Effect in Quartz Oscillators - J.E. Knowles  |
| 4-26-71  | Thermocompression Bonding to Quartz Crystals - R.J. Byrne  | 4-29-240 | A High Precision Laser Assisted X-Ray Goniometer for Circular Plates - J.R. Vig   |
| 4-26-78  | Modern Technologies - F. Ura   | 4-30-23  | Fracture Resistance of Synthetic $\alpha$ - Quartz Seed Plates - D.L. Brownlow  |
| 4-26-120 | Frequency Control Devices for High Stability Remote Sensor Transmitters - J.M. Stanley, H. Wasshausen and S. Schodowski    | 4-30-78  | A New Piezoelectric Resonator Design - R.J. Besson  |
| 4-26-152 | Precision and SSB Crystal Units for Temperature Compensated Crystal Oscillators - R.K. Hart and W.H. Hicklin               | 4-30-209 | Direct Plating to Frequency - A Powerful Method for Crystals with Closely Controlled Parameters - R. Fischer and L. Schulzke                              |
| 4-27-42  | Low Frequency Resonators of Lithium Tantalate - M. Onoe, T. Shinada, K. Itch and S. Miyazaki                               |          |   |
| 4-27-50  | Subminiature Quartz Tuning Fork Resonators - J. Staudte  |          |   |

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| 4-30-224 | Ceramic Flat Pack Enclosures for Precision Quartz Crystal Units - R.D. Peters   | 4-32-310 | Goniometric Measurements of the Angles of Cut of Doubly Rotated Quartz Plates - J. Clastre, C. Pegeot and P.Y. Leroy |
| 4-30-232 | Design of a Nozzle Beam Type Metal Vapor Source - R.P. Andres   | 4-32-317 | Fully Automated Piezognoniometer (Automatic Quartz Plate Classifier) - Y. Kobayashi                                  |
| 4-30-237 | An Evaluation of Leak Test Methods for Hermetically Sealed Devices - R.E. McCullough  | 4-32-321 | Basic Considerations on Metal Canned Enclosures for the Encapsulation of Quartz Crystal Units - D. Fuchs             |
| 4-30-240 | Characterization of Metal-Oxide System by High Resolution Electron Spectroscopy - E.J. Scheibner and W.H. Hicklin                         | 4-33-351 | Etching Studies on Singly and Doubly Rotated Quartz Plates - J.R. Vig, R.J. Brandmayr and R.L. Filler                |
| 4-30-249 | A Novel Method of Adjusting the Frequency of Aluminum Plated Quartz Crystal Resonators - V.E. Bottom                                      | 4-33-359 | Anisotropy of Etching Rate for Quartz in Ammonium Bifluoride - P. Suda, A.E. Zumsteg and W. Zingg                    |
| 4-30-254 | Polishing Layer of Crystal Plates - H. Fukuyo and N. Oura   | 4-33-364 | A Microprocessor Assisted Anodizing Apparatus for Frequency Adjustments - D. Ang                                     |
| 4-30-259 | A Method of Angle Correction - D. Husgen and C.C. Calmes  | 4-33-368 | Continuous Vacuum Processing System for Quartz Crystal Resonators - R.J. Ney and E. Hafner                           |
| 4-30-264 | The Effect of Bonding on the Frequency vs. Temperature Characteristics of AT-Cut Resonators - R.L. Filler and J.R. Vig                    | 4-34-34  | An On-Wafer Detection Method of the Imbalance of Quartz Tuning Fork Resonators - P.E. Debely and R.J. Dinger         |
| 4-31-122 | Acoustic Bulk Wave Resonators and Filters Operating in the Fundamental Mode at Frequencies Greater than 100 MHz - M. Berte                | 4-34-41  | A Micro-Processor Assisted Baseplating Apparatus with Improved Plateback Distribution - D. Ang                       |
| 4-31-126 | The Relationship Between Quartz Surface Morphology and the Q of High Frequency Resonators - R.N. Castellano, T.R. Meeker and R.C. Sundahl | 4-34-46  | Analysis of Quartz Resonator Electrodes Using the Rutherford Backscattering Technique - G.L. Dybwad                  |
| 4-31-131 | Chemically Polished Quartz - J.R. Vig, J.W. LeBus and R.L. Filler   | 4-34-112 | New Method to Saw Quartz Slides - H. Merigoux, J.F. Darces and J. Lamboley   |
| 4-31-144 | Aging Analysis of Quartz Crystal Units with Ti Pd Au Electrodes - G.L. Dybwad   | 4-34-120 | Highly Precise Measurement of Orientation Angle for Crystal Blanks - N. Asanuma and J. Asahara                       |
| 4-31-153 | Making Doubly Rotated Quartz Plates - W.L. Bond and J.A. Kusters  | 4-34-167 | Production Statistics of SC (or TTC) Crystals - J.A. Kusters and C.A. Adams  |
| 4-32-282 | Design and Implementation of an Etch System for Production Use - D. Ang   | 4-34-175 | Further Advances on B.V.A. Quartz Resonators - R.J. Besson and U.R. Peier  |
| 4-32-286 | Simplified Fixtures with Improved Thin Film Deposition Uniformity on Quartz Crystals - G.L. Dybwad  | 4-34-183 | Further Developments on 'SC' Cut Crystals - B. Goldfrank and A.W. Warner, Jr.  |
| 4-32-290 | Polyimide Bonded Resonators - R.L. Filler, J.M. Frank, R.D. Peters and J.R. Vig   | 4-35-40  | Vacuum Processing System for Quartz Crystal Resonators - J.M. Frank  |
| 4-32-304 | Final X-Ray Control of the Orientation of Round or Rectangular Quartz Slides for Industrial Purposes - J.F. Darces and H. Merigoux        | 4-35-48  | Metallization of Quartz Oscillators - A.T. Lowe  |
|          |   | 4-35-56  | X-Ray Goniometry of the Modified Doubly Rotated Cuts - E. Knolmayer  |

# CATEGORY 4 (Cont'd):

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| 4-35-60  | An Instrument for Automated Measurement of the Angles of Cut of Doubly Rotated Quartz Crystals - J.L. Chambers, M.A. Pugh, S.T. Workman, R.W. Birrell and R.J. Valihura     | 4-39-333 | Laser Processed Miniature LiTaO Resonators and Monolithic Filters - R. Lefevre, L. Jenseime and D. Servajean                                       |
| 4-35-104 | Adjusting the Frequency vs. Temperature Characteristics of SC-Cut Resonators by Contouring - J.R. Vig, W. Washington and R.L. Filler  | 4-39-338 | A Progress Report on Manufacturing Methods and Technology for Production of High-Stability, Vibration-Resistant Quartz Crystal Units - J.C. Korman |
| 4-35-237 | Air-Gap Probe Evaluation of Thin Quartz Plates - L.N. Dworsky and G. Kennedy  | 4-39-342 | Cut and Grind - A.W. Warner, Jr., J. Tsacilas and J. Korman  |
| 4-36-90  | A Method of Adjusting Resonant Frequency and Frequency-Temperature Coefficients of Miniaturized GT-Cut Quartz Resonators - O. Ochiai, A. Kudo, A. Nakajima and H. Kawashima | 4-39-345 | Low Profile Glass Packaged Crystal Unit - M. Sato, J. Eguchi, S. Ishigami and K. Yamamoto  |
| 4-36-108 | DC Plasma Anodization of Quartz Resonators - C.W. Shanley and L.N. Dworsky  | 4-39-367 | Processing of a Five Resonator VHF Crystal Device - C.W. Shanley, L.N. Dworsky, J.A. Whalin, G.C. Clifford and M.N. Scansaroli                     |
| 4-36-208 | Further Development in SC Cut Crystal Resonator Technology - A.W. Warner, Jr., B. Goldfrank and J. Tsacilas   | 4-39-475 | Applications of Total Process Control Techniques in the Production of High Precision Quartz Resonators - J.A. Kusters and C.A. Adams               |
| 4-37-261 | Chemically Polished High Frequency Resonators - W.P. Hanson   | 4-39-519 | A New All Quartz Package for SAW Devices - T.E. Parker, J. Callerame and G.K. Montress   |
| 4-38-101 | Reactive Ion Beam Etching for VHF Crystal Resonators - J.S. Wang, S.K. Watson and K.F. Lau  | 4-40-86  | Further Results on the Use of Surfactants in Chemically polishing Quartz Crystals - R.J. Brandmayr and J.R. Vig                                    |
| 4-38-114 | Chip Crystal Resonator with Load Capacitors - Y. Kojima, Y. Fujiwara, S. Yamada and N. Wakatsuki  | 4-40-115 | The Influence of Surface Finish and Metallization on Electrode Electromigration in Alpha-Quartz During Sweeping - J.G. Gualtieri and D.W. Eckart   |
| 4-38-119 | AT-Cut Strip Resonators Enclosed in Cylindrical Package - M. Okazaki and N. Manabe  | 4-40-140 | Angle in a Triply Rotated Cut, Determination and Control - H. Merigoux and J.F. Darces   |
| 4-38-225 | Aging Studies on Quartz Crystal Resonators and Oscillators - R.L. Filler, J.A. Kosinski, V.J. Rosati and J.R. Vig   | 4-41-199 | Effects of Initial Quartz Surface Finish and Etch Removal on Etch Figures and Quartz Crystal Q - K.H. Jones  |
| 4-39-271 | Etching Study of AT-Cut Cultured Quartz Using Etchants Containing Fluoride Salts, Hydrofluoric Acid, and Ammonium Bifluoride - A.J. Bernot                                  | 4-41-243 | Computing Crystal Orientation from X-Ray Measurements - J.H. Sherman, Jr.  |
| 4-39-276 | Chemical Polishing in Etching Solutions That Contain Surfactants - R.J. Brandmayr and J.R. Vig  | 4-41-249 | X-Ray Technology - A Review - C.A. Adams, D.C. Bradley and J.A. Kusters  |
| 4-39-292 | Chemically Milled VHF and UHF AT-Cut Resonators - J.R. Hunt and R.C. Smythe   | 4-41-258 | An Update of Surface Mount Packages for Quartz Crystal Products - C. Mercer  |
| 4-39-301 | Etch Processing of Bulk and Surface Wave Devices - J. Dowsett, D.F.G. Dwyer, F. Stern, R.A. Heinecks and A.H. Truelove  | 4-41-351 | A Novel Technique for Trimming the Frequency of a Sealed Surface Acoustic Wave Resonator - J.A. Greer, T.E. Parker, M. Rothschild and D.J. Ehrlich |

CATEGORY 4 (Cont'd):

- 4-41-360 Parametric Failure Rate Model for Quartz Crystal Device Aging with Application to Surface Acoustic Wave Filters - A.A. Feinberg
- 4-41-429 Fabrication and Methods for Evaluation and Circuit Utilization of Prototype Lateral Field Resonators - M.M. Driscoll and W.P. Hanson
- 4-41-444 The Aging of Resonators and Oscillators Under Various Test Conditions - R.L. Filler, R. Lindenmuth, J. Messina, V.J. Rosati and J.R. Vig
- 4-41-548 Use of Annular SAW for Cutting Quartz Resonator Blanks and Comparison with Other Methods - J. Dowsett, R.B. Spencer and A.F.B. Wood
- 4-42-85 Stroboscopic X-Ray Topography of Quartz Resonators - A. Zarka, B. Capelle, Y. Zheng, M. Curie, J. Detaint and J. Schwartzel
- 4-42-93 Probe Examination of Thickness-Shear Vibrations of AT-Cut Natural Quartz Crystals: Some New Results - R. Parshad and A. Sharma
- 4-42-189 New Technology for Detection and Removal of Surface Contamination Involving Particulates or Water/Organic Materials (Invited Paper) - S. Hoenig
- 4-42-202 Measurement of Plano-Convex SC Quartz Blanks Using Lateral Field Excitation - A.W. Warner, Jr.
- 4-42-205 Use of Annular SAW for the Cutting of Quartz Resonator Blanks and Substrates - J. Dowsett, R.B. Spencer and P.E. Morley
- 4-42-208 X-Ray Topographic Study of Vacuum Swept Quartz Crystals - A. Zarka, M. Sebastian and B. Capelle
- 4-42-211 A New Shutter System for Fine-Tuning Coupled-Dual Crystals - G. Roberts
- 4-42-404 Aging Prediction of Quartz Crystal Units - M. Miljkovic, G. Trifunovic and V. Brajovic
- 4-42-412 Experimental Results of Aging of AT-Cut Strip Resonators - J. Gehrke and R. Klawitter



# CATEGORY 5:

## Filters, Surface and Shallow Bulk Acoustic Wave Devices, Other

### Nonquantum-electronic Microwave Resonators, and Non-Piezoelectric

#### Acoustic Resonators

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|----------|---|----------|---|
| 5-10-339 | High-Frequency Crystal Filters - D.I. Kosowsky  | 5-20-103 | Improved VHF Filter Crystals using Insulating Film Techniques - D.J. Koneval, W.J. Gerber and D.R. Curran   |
| 5-11-535 | Latest Developments in Mechanical Filters - J.C. Hathaway   | 5-20-131 | Design and Fabrication of Modern Filter Crystals - A.D. Ballato, T.J. Lukaszek, H. Wasshausen and E. Chabak                                       |
| 5-11-556 | High-Frequency Crystal Filters - L. Storch  | 5-20-266 | High Frequency Crystal Filters Employing Multiple Mode Resonators Vibrating in Trapped Energy Modes - M. Onoe, H. Jumonji and N. Kobori           |
| 5-12-437 | Filter Crystals - R. Bechmann   | 5-20-288 | High Frequency Monolithic Crystal Filters with Possible Application to Single Frequency and Single Side Band Use - R.A. Sykes and W.D. Beaver     |
| 5-12-475 | High Frequency Crystal Filters - R.A. Sykes   | 5-20-309 | Incorporation of Multi-Resonator Crystals into Filters for Quantity Production - H. Mailer and D.R. Beuerle                                       |
| 5-12-501 | Type NB Bandpass Crystal Filters - L. Storch  | 5-20-343 | Tolerance Considerations in Crystal Filter Design - R.C. Smythe   |
| 5-13-404 | Single-Side-Band Crystal Filters - M. Dishal  | 5-20-352 | A Temperature Compensation Technique for Crystal Filters - E.C. Ho and K. Lichtenfeld   |
| 5-13-405 | Quartz Crystal Mechanical Filters - H. Yoda   | 5-21-83  | Alternate Approaches to High Frequency Filter Crystals - D.A. Roberts, D.J. Koneval and T.R. Sliker   |
| 5-14-361 | VHF Crystal Filters - F.K. Priebe and D. Schwab   | 5-21-138 | Physical Realization of Miniature Bandpass Filters with Single Frequency or Single Sideband Characteristics - D.I. McLean                         |
| 5-15-318 | Transfer Function Synthesis of Quartz Crystal Filters - E.C. Ho   | 5-21-160 | Theory of Thickness-Shear Vibrators, with Extensions and Applications to VHF Acoustically-Coupled-Resonator Filters - W.H. Horton and R.C. Smythe |
| 5-16-347 | HF and VHF Crystal Filters - S. Malinowski and D. Schennberg  | 5-21-179 | Theory and Design of the Monolithic Crystal Filter - W.D. Beaver  |
| 5-16-373 | High Frequency Crystal Electromechanical Filters - Y. Nakazawa  | 5-22-188 | High Frequency Crystal Mechanical Filters - H. Yoda, Y. Nakazawa and N. Kobori  |
| 5-17-566 | Recent Developments in Crystal Filters - D.I. Kosowsky and C. Hurtig  | 5-23-65  | The Development of High Performance Filters Using Acoustically Coupled Resonators on AT-Cut Quartz Crystals - J.F. Werner, A.J. Dyer and J. Birch |
| 5-18-536 | The Synthesis of Crystal-Capacitor Tandem Lattice All-Pole Bandpass Filters on the Insertion-Loss Basis - R.C. Smythe | 5-23-76  | High Frequency Crystal Monolithic (HCM) Filters - H. Yoda, Y. Nakazawa and N. Kobori  |
| 5-18-558 | Crystal Filter Techniques - S. Malinowski   | 5-24-16  | Surface Waves and Devices - H.J. Shaw   |
| 5-19-42  | Ultrasonic Tapped Delay Lines for Filter Applications - G.A. Coquin   |          |   |
| 5-19-213 | Factors in the Design of VHF Filter Crystals - D.R. Curran and D.J. Koneval   |          |   |
| 5-19-269 | Improvements of Quartz Filter Crystals - T.J. Lukaszek  |          |   |
| 5-19-509 | Design of SSB and VHF Crystal Filters - E.C. Ho and R.H. Tuznik   |          |   |
| 5-19-534 | Trapped Energy Modes, Network Synthesis, and the Design of Quartz Filters - A.D. Waren, W.J. Gerber and D.R. Curran   |          |   |

# CATEGORY 5 (Cont'd):

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|----------|--|----------|---|
| 5-24-21  | Zero Temperature Coefficient Ultrasonic Delay Lines Utilizing Synthetic Quartz Crystals as Delay Media - M. Onoe and Y. Mochizuki                      | 5-26-257 | A Superconducting Cavity Stabilized Oscillator - S.R. Stein and J.P. Turneaure  |
| 5-24-74  | Review of Digital Filtering - J.D. Heightley   | 5-26-257 | A Superconducting Cavity Stabilized Oscillator - S.R. Stein and J.P. Turneaure  |
| 5-24-78  | Active Filter Capabilities - P. Geffe  | 5-27-227 | Monolithic Crystal Filter with Attenuation Poles Utilizing 2-Dimensional Arrangement of Electrode - Y. Masuda, I. Kawakami and M. Kobayashi |
| 5-24-83  | Generalized Filters Using Surface Ultrasonic Waves - M.G. Holland  | 5-27-233 | Effects of Asymmetry in Trapped Energy Piezoelectric Resonators - A. Glowinski, R. Lancon and R. Lefevre                                    |
| 5-24-84  | Monolithic Crystal Filters - R.J. Byrne  | 5-27-243 | Experimental Investigations of Intermodulation in Monolithic Crystal Filters - W.H. Horton and R.C. Smythe                                  |
| 5-24-93  | Preparation of Quartz Crystal Plates for Monolithic Crystal Filters - A.J. Miller  | 5-27-246 | Single Mode Resonance in Lithium Niobate/Lithium Tantalate for Monolithic Crystal Filters - J.W. Burgess                                    |
| 5-24-104 | A Technique for Automatic Monolithic Crystal Filter Frequency Adjustment - R.P. Grenier  | 5-27-253 | Some Practical Design Considerations of Dispersive Surface Wave Filters - W.J. Skudera, Jr. and H.M. Gerard                                 |
| 5-25-246 | Energy Trapping in a Lithium Tantalate X-Cut Resonator - K. Sawamoto   | 5-27-262 | A Novel Frequency Selective Device: The Stacked Crystal Filter - A.D. Ballato and T.J. Lukaszek   |
| 5-25-251 | CdS-Quartz Monolithic Filters for Use in the 100-500 MHz Frequency Range - D.A. Roberts  | 5-27-406 | S and X-Band Superconducting Cavity Stabilized Oscillators - J.J. Jimenez and A. Septier  |
| 5-25-262 | Consideration About Channel Filters for a New Carrier Frequency System with Mechanical Filters - H. Schussler  | 5-27-414 | The Development of Superconducting Cavity Stabilized Oscillators - S.R. Stein and J.P. Turneaure  |
| 5-25-271 | Semi-Monolithic Quartz Crystal Filters and Monolithic Quartz Filters - L. Bidart   | 5-28-33  | Filter Applications in Communications and Electronics Industry - C.F. Kurth   |
| 5-25-280 | Monolithic Crystal Filters for Frequency Division Multiplex - P. Lloyd   | 5-28-43  | Energy Trapped Vibrations in Lithium Tantalate and Lithium Niobate Resonators - M.C. Hales, J.W. Burgess and R.J. Porter                    |
| 5-25-287 | Composite Filter Structures Incorporating Monolithic Crystal Filters and L-C Networks - H.A. Simpson, E.D. Finch, Jr., R.K. Weeman and A.N. Georgiades | 5-28-256 | RF Oscillator Control Utilizing Surface Wave Delay Lines - H.G. Vollers and L.T. Claiborne  |
| 5-26-164 | VHF/UHF Bandpass Filters Using Piezoelectric Surface Wave Devices - C.S. Hartmann, T.F. Cheek and H.G. Vollers   | 5-28-260 | Surface Acoustic Wave Oscillator Experiments - A.K. Nandi, S.T. Costanza and C.E. Wheatley III  |
| 5-26-171 | Charge Transfer Devices in Frequency Filtering - D.D. Buss, C.R. Reeves, W.H. Bailey and D.R. Collins  | 5-28-266 | Surface Acoustic Wave Oscillators - H.E. Karrer and J.F. Dias   |
| 5-26-180 | Intermodulation in Crystal Filters - S. Malinowski and C. Smith  | 5-28-280 | UHF Surface Acoustic Wave Crystal Resonators - E.J. Staples   |
| 5-26-187 | The Design of Compact Monolithic Crystal Filters for Portable Telecommunications Equipment - G.R. Kohlbacher   | 5-28-286 | On the Design of Elastic Surface Wave Filters with No Tuning Coil - H. Sato, K. Yamanouchi, K. Shibayama and S. Nishiyama                   |
| 5-26-193 | A Superconductive Tunable Filter With Broad Tuning Range - J.R. Vig and E. Gikow   |          |   |

# CATEGORY 5 (Cont'd):

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|----------|--|----------|---|
| 5-28-299 | Low-Loss Unidirectional Acoustic Surface Wave Filters - R.C. Rosenfeld, C.S. Hartmann and R.B. Brown   | 5-30-109 | A Hybrid Integrated Monolithic Crystal Filter - T. Watanabe and K. Okuno  |
| 5-28-304 | The Surface Acoustic Wave Oscillator - A Natural and Timely Development of the Quartz Crystal Oscillator - M.F. Lewis  | 5-30-119 | Surface Acoustic Wave VIF Filters for TV Using ZnO-Sputtered Film - S. Fujishima, H. Ishiyama, A. Inoue and H. Ieki                               |
| 5-29-77  | Frequency Filtering Using Charge Coupled Devices - C.R. Hewes, D.D. Buss and R.W. Brodersen  | 5-30-123 | Filtering with Analog CCD and SAW Devices - D.D. Buss, L.T. Claiborne, C.S. Hartmann and C.R. Hewes   |
| 5-29-88  | Practical Application of CCD-Transversal Filters in Communication Systems - R.D. Baertsch, W.J. Butler, W.E. Engeler, H.S. Goldberg, O. Mueller, C.M. Puckette, J.J. Tiemann and J.J. VandeGraaf | 5-30-157 | Progress Report on Surface Acoustic Wave Device MMT - A.R. Janus  |
| 5-29-105 | A6 Monolithic Crystal Filter Design for Manufacture and Device Quality - S.H. Olster, I.R. Oak, G.T. Pearman, R.C. Rennick and T.R. Meeker   | 5-30-322 | SAW Resonators and Coupled Resonator Filters - E.J. Staples and R.C. Smythe   |
| 5-29-113 | Manufacture of Monolithic Crystal Filters for the A-6 Channel Bank - H.F. Cawley, J.D. Jennings, J.I. Pelc, P.R. Perri, F.E. Snell and A.J. Miller   | 5-30-328 | Two-Port Quartz SAW Resonators - W.R. Shreve  |
| 5-29-120 | Polyolithic Crystal Filters - D.F. Sheahan   | 5-30-334 | Surface Acoustic Wave Ring Filter - T.E. Parker and F. Sandy  |
| 5-29-135 | A Survey of Current SAW Device Capabilities - L.T. Claiborne   | 5-30-340 | Optical Waveguide Model for SAW Resonators - J.S. Schoenwald  |
| 5-29-150 | Surface Acoustic Wave Resonator Development - J.S. Schoenwald, W.R. Shreve and R.C. Rosenfeld  | 5-30-346 | Design of Quartz and Lithium Niobate SAW Resonators Using Aluminum Metallization - W.H. Haydl, P. Hiesinger, B. Dischler, R.S. Smith and K. Heber |
| 5-29-158 | Equivalent Circuit and Properties of Surface Wave Planar Resonators - K.M. Lakin and T.R. Joseph   | 5-30-358 | Aging Effects in Plasma Etched SAW Resonators - D.T. Bell, S.P. Miller and L.A. Simonson  |
| 5-29-167 | Surface-Wave Resonators Using Grooved Reflectors - R.C.M. Li, J.A. Alusow and R.C. Williamson  | 5-30-363 | The Periodic Grating Oscillator (PGO) - R.D. Weglein and O.W. Otto  |
| 5-29-177 | Oversampled SAW Filter Transducers B.J. Hunsinger and R.J. Kansy   | 5-30-367 | Fast Frequency Hopping with Surface Acoustic Wave (SAW) Frequency Synthesizers - L.R. Adkins  |
| 5-29-181 | Experimental Investigation of Mass-Producible Acoustic Surface Wave Filter - G. Coussot and G. Menager   | 5-31-187 | CCD Recursive Filter for MTI Applications - W.L. Eversole, W.H. Bailey and P.L. Ham   |
| 5-29-321 | Application of Superconductivity to Precision Oscillators - S.R. Stein   | 5-31-191 | Unwanted Modes in Monolithic Crystal Filters - G.T. Pearman and R.C. Rennick  |
| 5-30-12  | Static Strain Effects on Surface Acoustic Wave Delay - R.B. Stokes and K.M. Lakin  | 5-31-197 | Multi-Mode Stacked Crystal Filter - C.M. Stearns, S. Wanuga, S.W. Tehon and A. Kachelmyer   |
| 5-30-103 | An Analysis of Overtone Modes in Monolithic Crystal Filters - H.F. Tiersten  | 5-31-207 | 128 kHz Pole-Type Mechanical Channel Filter - K. Yakuwa, S. Okuda, K. Shirai and Y. Kasai   |
|          |  | 5-31-213 | Lithium Tantalate Channel Filters for Multiplex Telephony - T. Arranz   |
|          |  | 5-31-225 | 1.2 GHz Temperature-Stable SAW Oscillator - R.D. Weglein  |
|          |  | 5-31-231 | Tuning Quartz SAW Resonators by Opening Shorted Reflectors - R.C. Rosenfeld, T.F. O'Shea and S.H. Arneson   |

# CATEGORY 5 (Cont'd):

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| 5-31-240 | Tunable Variable Bandwidth/Frequency SAW Resonators - J.S. Schoenwald   | 5-32-77  | Higher Order Temperature Coefficients of Quartz SAW Oscillators - D. Hauden, M. Michel and J.J. Gagnepain                         |
| 5-31-246 | Deeply Etched SAW Resonators - C.A. Adams and J.A. Kusters  | 5-32-87  | A New Cut of Quartz Giving Improved Temperature Stability to SAW Oscillators - T.I. Browning and M.F. Lewis                       |
| 5-31-251 | Piezoelectric Shear Surface Wave Grating Resonators - B.A. Auld and B.H. Yeh  | 5-32-95  | Temperature Stable Shallow Bulk Acoustic Wave Devices - K.H. Yen, K.F. Lau and R.S. Kagiwada                                      |
| 5-31-258 | A New Class of Quartz Crystal Oscillator Controlled by Surface-Skimming Bulk Waves - T.I. Browning and M.F. Lewis                     | 5-32-220 | Some Recent Advances in Integrated Crystal Filters - R.C. Smythe  |
| 5-31-266 | Interdigital Transducers---A Means of Efficient Bulk Wave Excitation - K.H. Yen, K.L. Wang, R.S. Kagiwada and K.F. Lau                | 5-32-233 | A Polyolithic Crystal Filter Employing A Rhodes Transfer Function - P.A. Herzig and T.W. Swanson                                  |
| 5-31-271 | Surface Acoustic Wave Scattering From a Groove in Y-Z LiNbO <sub>3</sub> - S.D. Wu and H.S. Tuan                                      | 5-32-244 | A Selective Linear Phase Crystal Filter - P. Siffert and J. Kerboull  |
| 5-31-275 | UHF Range SAW Filters Using Group-Type Uni-Directional Interdigital Transducers - J. Otomo, S. Nishiyama, Y. Konno and S. Shibayama   | 5-32-250 | Crystal Filter AM-PM Conversion Measurements - T.W. Swanson   |
| 5-31-281 | Progress Report on Surface Acoustic Wave Device MMT - II - A.R. Janus and L. Dyal III   | 5-32-385 | 10 GHz Cavity Stabilized FET Oscillator - B.E. Rose   |
| 5-31-285 | The Versatility of the "In-Line" SAW Chirp Filter - W.J. Skudera, Jr.   | 5-33-148 | Monolithic Crystal Filters With High Q Factor and Low Spurious Level - R. Lefevre   |
| 5-31-359 | Current Developments in SAW Oscillator Stability - T.E. Parker  | 5-33-166 | New Discrete Crystal Filters for Bell System Analog Channel Banks - D.I. McLean, A.F. Graziani and J.J. Royer                     |
| 5-31-365 | SAW Oscillators for Phase Locked Applications - T.R. Joseph   | 5-33-173 | The Design and Application of Electromechanical Single Silicon Beam Filters - M.F. Hribsek  |
| 5-31-371 | 300 MHz Oscillators Using SAW Resonators and Delay Lines - E.J. Staples and T.C. Lim  | 5-33-206 | Digital Filters - An Overview - F.J. Witt   |
| 5-31-616 | Clocks Based Upon High Mechanical Q Single Crystals - D.F. McGuigan and D.H. Douglass   | 5-33-209 | Modern Crystal Filters - R.C. Smythe  |
| 5-32-50  | SAW Devices for Use in a High Performance Television Tuner - R.E. Stigall and W.R. Shreve   | 5-33-214 | CCD and Switched Capacitor Filters - C.R. Hewes   |
| 5-32-58  | Design and Construction of SAW Oscillators for Secondary Radar Systems - H. Eschler, L. Sanchez-Hermosilla, W.E. Bulst and P. Schucht | 5-33-220 | Surface Acoustic Wave (SAW) Bandpass Filter Review - R.C. Rosenfeld   |
| 5-32-66  | Vibration Effects on Close in Phase Noise of a 300 MHz Surface Wave Resonator Oscillator - R. Allison and S.J. Goldman                | 5-33-223 | Mechanical Filters - E.M. Frymoyer  |
| 5-32-74  | Improved Long-Term Aging in Deeply Etched SAW Resonators - C.A. Adams and J.A. Kusters  | 5-33-374 | Hybrid Saw Oscillator Fabrication and Packaging - S.J. Dolochycki, E.J. Staples, J. Wise, J.S. Schoenwald and T.C. Lim            |
|          |   | 5-33-379 | Stability of Phase Shift on Quartz Saw Devices - T.E. Parker and D.L. Lee   |
|          |   | 5-33-388 | Analysis of Shallow Bulk Acoustic Wave Excitation by Interdigital Transducers - K.F. Lau, K.H. Yen, J.Z. Wilcox and R.S. Kagiwada |

# CATEGORY 5 (Cont'd):

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|----------|---|----------|---|
| 5-33-396 | L-Band Low Loss Saw Filters - B.R. Potter   | 5-34-445 | The Overlapping Ground - A New Monolithic Crystal Filter Configuration - J.L. Dailing   |
| 5-33-402 | A New Cut of Quartz with Orthogonal Temperature-Compensated Propagation Directions for Surface Acoustic Wave Applications - R.M. O'Connell  | 5-35-13  | The Role of Analog Devices in a Digital Age - R.C. Williamson   |
| 5-34-221 | SAW Stabilized 1680 MHz Microwave Oscillator - D.J. Dodson, K.F. Lau, M.Y. Huang and T.J. Lukaszek  | 5-35-244 | Laser Processed VHF Monolithic Crystal Filters With On Plate Integrated Matching Impedances - R. Lefevre  |
| 5-34-237 | A Temperature Stable 2 GHz SBAW Delay Line Oscillator - K.R. Lau, K.H. Yen, R.S. Kagiwada and A.M. Kong   | 5-35-257 | Equivalent Circuit Modelling of Stacked Crystal Filters - K.M. Lakin  |
| 5-34-243 | High Q Bulk Acoustic Resonators for Direct Microwave Oscillator Stabilization - R.A. Moore, J. Goodell, A. Zahorchak, R.A. Sundelin, F.W. Hopwood, T. Haynes, B.R. McAvoy and J. Murphy | 5-35-345 | Commercial Satellite Navigation Using Saw Oscillator - B.Y. Lao, N.J. Schneier, D.A. Rowe, R.E. Dietterle, J.S. Schoenwald, E.J. Staples and J. Wise            |
| 5-34-252 | Frequency Stable Sources Using Superconducting Microstrip Resonators - R. Davidheiser   | 5-35-349 | UHF Voltage-Controlled Narrow-Bandwidth Saw Filters - J. Henaff, M. Feldmann and M. Carel   |
| 5-34-255 | Non-Linear Propagation of Surface Acoustic Waves on Quartz - M. Planat, D. Hauden, J. Gros Lambert and J.J. Gagnepain   | 5-35-352 | Saw Filter Technology and Applications - B.R. Potter and D.B. MacDonald   |
| 5-34-262 | Theoretical Analysis of Second-Order Effects in Surface-Wave Gratings - P.V. Wright and H.A. Haus   | 5-35-358 | The Status of Magnetostatic Wave Devices - J.M. Owens, C.V. Smith, Jr. and R.L. Carter  |
| 5-34-269 | Surface Acoustic Wave Resonators with Hermite-Gaussian Transverse Modes - F. Pirio and P. Desrousseaux  | 5-35-376 | The Propagation Characteristics of Surface Acoustic Waves on Singly and Doubly Rotated Cuts of Quartz - D.F. Williams, F.Y. Cho, A.D. Ballato and T.J. Lukaszek |
| 5-34-273 | SAW Resonator 2-Pole Filters - E.J. Staples, J. Wise, J.S. Schoenwald and T.C. Lim  | 5-35-383 | Absolute and Differential Aging of SAW Resonator Pairs - J.S. Schoenwald, J. Wise and E.J. Staples  |
| 5-34-278 | UHF SAW Resonators and Applications - W.J. Tanski   | 5-35-388 | Elements of SAW Resonator Fabrication and Performance - W.J. Tanski   |
| 5-34-286 | SH-Type Surface Acoustic Waves on Rotated Y-Cut Quartz - T. Nishikawa, A. Tani, K. Shirai and C. Takeuchi   | 5-35-395 | GaAs SAW Resonator Oscillators with Electronic Tuning - M. Gilden and T.W. Grudkowski   |
| 5-34-292 | Analysis of Aging Data on SAW Oscillators - T.E. Parker   | 5-35-401 | Shallow Bulk Acoustic Waves in Berlinite - K.F. Lau, K.H. Yen, R.B. Stokes, R.S. Kagiwada and B.H.T. Chai   |
| 5-34-302 | Numerical Analysis of Doubly Rotated Cut SAW Devices - D.F. Williams and F.Y. Cho   | 5-35-436 | Advanced SAW-LSI Frequency Synthesizer - D.J. Dodson, M.Y. Huang and M.D. Brunsman  |
| 5-34-307 | Observations of Effects Induced by Dielectric Coatings on SSBW and SAW Devices - C.N. Helmick, Jr. and D.J. White   | 5-36-270 | Inertial Guidance and Underwater Sound Detection Using SAW Sensors - E.J. Staples, J. Wise and A.P. Andrews   |
| 5-34-312 | Sensitivities of SAW Oscillators to Temperature, Forces and Pressure: Application to Sensors - D. Hauden, S. Rousseau and J.J. Gagnepain  | 5-36-276 | A Surface Acoustic Wave Gas Detector - A. Bryant, M. Poirier, D.L. Lee and J.F. Vetelino  |

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| 5-36-284 | Pressure and Temperature Measurements with SAW Sensors - D. Hauden, S. Rousseau, G. Jaillet and R. Coquerel  | 5-37-239 | Acoustically Coupled Resonators: Filters and Pressure Transducers - J. Detaint, H. Carru, P. Amstutz and J. Schwartzel                            |
| 5-36-389 | Intermediate Bandwidth Quartz Crystal Filters - A Simple Approach to Predistortion - R.C. Peach, A.J. Dyer, A.J. Byrne, E. Read and J.K. Stevenson | 5-37-349 | Current Trends in Crystal Filters - R.C. Smythe, M.D. Howard  |
| 5-36-396 | Developments in Low Loss, Low Ripple SAW Filters K.H. Yen, K.F. Lau, R.B. Stokes, A.M. Kong and R.S. Kagiwada                                      | 5-37-354 | Surface Acoustic Wave Bandpass Filters - C.S. Hartmann and S. Wilkus  |
| 5-36-400 | Multipole SAW Resonator Filters - W.J. Tanski  | 5-37-361 | EHF Waveguide Filters - J.E. Raue   |
| 5-36-405 | Recent Advances in UHF Crystal Filters - B. d'Albaret and P. Siffert   | 5-37-362 | Digital Filters: An Overview - L. Sheats  |
| 5-36-419 | Magnetostatic Wave Multi-Channel Filters - J.D. Adam   | 5-37-371 | Microeletronic Analog Active Filters - R. Schaumann   |
| 5-36-428 | Application of SAW Convolvers and Correlators - H. Gautier   | 5-37-376 | Timing Tank Mechanical Filter for Digital Subscriber Transmission System - T. Gounji, T. Kawatsu, Y. Kasai, T. Takeuchi, Y. Tomikawa and M. Konno |
| 5-36-442 | Ultrareproducible SAW Resonator Production - W.E. Bulst and E. Willibald   | 5-37-387 | Stripline Filters - An Overview - L.N. Dworsky  |
| 5-36-453 | Development of Precision SAW Oscillators for Military Applications - T.E. Parker   | 5-37-394 | Precision L-Band SAW Oscillator for Satellite Application - T.F. O'Shea, V. Sullivan and R. Kindell   |
| 5-36-459 | Effects of RIE Tuning on the Electrical and Temperature Characteristics of Quartz SAW Resonators - C. Kotecki                                      | 5-37-405 | SAW Resonator Stabilized Oscillator - C. Bennett  |
| 5-36-470 | Frequency Fine Tuning of Reliable SAW Transducers Using Anodization Technique - F.Y. Cho, T.B. Chatham and R. Ponce de Leon                        | 5-37-410 | Very Long Period Random Frequency Fluctuations in SAW Oscillators - T.E. Parker   |
| 5-36-486 | Reducing SAW Oscillator Temperature Sensitivity with Digital Compensation - A.J. Slobodnik, Jr., R.D. Colvin, G.A. Roberts and J.H. Silva          | 5-37-415 | Stress Induced Effects on the Propagation of Surface Waves - B.K. Sinha, W.J. Tanski, T.J. Lukaszek and A.D. Ballato                              |
| 5-36-517 | Aluminum Nitride Thin Film and Composite Bulk Wave Resonators - K.M. Lakin, J.S. Wang and A.R. Landin  | 5-37-423 | Surface Wave Resonators on Silicon - S.J. Martin, R.L. Gunshor, T.J. Miller, S. Datta, R.F. Pierret and M.R. Melloch                              |
| 5-36-525 | SAW and SSBW Propagation in Indium Phosphide - J. Henaff and M. Feldmann   | 5-37-428 | High-Frequency Shallow Bulk Acoustic Wave Quartz Frequency Sources - K.V. Rousseau, K.H. Yen, K.F. Lau and A.M. Kong                              |
| 5-36-537 | Progress in the Development of Miniature Thin Film BAW Resonator and Filter Technology - T.W. Grudkowski, J.F. Black, G.W. Drake and D.E. Cullen   | 5-37-473 | MSSW Delay Line Based Oscillators - V. Lander and J.P. Parekh   |
| 5-37-81  | Superconductive Tapped Delay Line for Low-Insertion-Loss Wideband Analog Signal-Processing Filters - R.S. Withers and P.V. Wright                  | 5-37-477 | The Status of Magnetostatic Wave Oscillators - R.L. Carter and J.M. Owens   |
|          |  | 5-37-481 | An X-Band GaAs FET Oscillator Using a Dielectric Resonator - K. Wakino, T. Nishikawa, S. Tamura and H. Tamura                                     |
|          |  | 5-38-251 | Filter Applications of High Frequency Chemically Polished Fundamental Mode Bulk Wave Quartz Crystal Resonators - P.J. Kavolis and W.P. Hanson     |

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| 5-38-254 | A New Generation of UHF Filters from 300 MHz to Some GHz Using "Dielectric Resonators" - B. d'Albaret                             | 5-39-491 | Monolithic Crystal Filters Having Improved Intermodulation & Power Handling Capability - M.D. Howard, R.C. Smythe and P.E. Morley             |
| 5-38-263 | Temperature Stable Microwave Resonators Using ZnO Shear Mode Transducers - S.V. Krishnaswamy, B.R. McAvoy and R.A. Moore          | 5-39-504 | Monolithic Filters Using Ion Etched Fundamental Mode Resonators Between 60 and 100 MHz - J. Brauge, M. Fragneau and J.P. Aubry                |
| 5-38-266 | Performance of Fundamental-Mode UHF Oscillators Using Bulk-Acoustic-Wave Resonators - S.G. Burns and R.S. Ketcham                 | 5-39-514 | Scattering Parameters of Electrically Loaded SAW Group Type Unidirectional Transducers - A.R. Reddy and S.K. Lahiri                           |
| 5-38-271 | A Review of Surface Acoustic Wave Devices and their Current Applications - R.C. Rosenfeld and R.M. Hays                           | 5-40-252 | Real Time, Interactive Saw Filter Computer Aided Design and Analysis Implementation - S.M. Richie, C.D. Bishop and D.C. Malocha               |
| 5-38-273 | The Effects of Temperature, RF Power, Radiation and Time on SAW Resonator Electrical Characteristics - A.I. Vulcan and C. Gloeckl | 5-40-257 | On a Continuous Representation of the Mode Shape in Acoustic Surface Wave Resonators - H.F. Tiersten and D.V. Shick                           |
| 5-38-279 | Tuning SAW Oscillators Using Magnetic Bubble Garnet Films - S.M. Hanna and F.J. Friedlander                                       | 5-40-275 | Wideband Timing Tank Filters for Digital Transmission Systems - S. Yamamoto, T. Gounji and J. Shimizu   |
| 5-38-282 | SBAW Versus SAW Oscillator Aging - R.B. Stokes, K.H. Yen and K.F. Lau   | 5-40-385 | The BASS FET Oscillator - Its Signal and Noise Performance - R.A. Pucel   |
| 5-38-286 | Narrow Bandpass Filter Using Double-Mode SAW Resonators on Quartz - M. Tanaka, T. Morita, K. Ono and Y. Nakazawa                  | 5-40-392 | Magnetically Tunable High Overtone Microwave Resonators - J.D. Adam, B.R. McAvoy and H.L. Salvo, Jr.  |
| 5-38-294 | Theoretical Analysis of Dynamic Thermal Effects in SAW Devices - G. Theobald and D. Hauden  | 5-41-365 | Approximation Method for Plate Modes in Surface Acoustic Wave Devices - J.P. Hou  |
| 5-38-300 | Transient Thermal Response of Surface Acoustic Wave Resonators - B.K. Sinha   | 5-41-371 | Thin Film Resonator Technology - K.M. Lakin, G.R. Kline, R.S. Ketcham, A.R. Landin, W.A. Burkland, K.T. McCarron, S.D. Braymen and S.G. Burns |
| 5-38-310 | Bias Controlled Frequency Trimming of SAW Devices in a DC <sub>02</sub> Plasma - J. Day, T.E. Parker and G. Jackson               | 5-41-382 | UHF Oscillator Performance Using Thin Film Resonator Based Topologies - S.G. Burns, G.R. Kline and K.M. Lakin                                 |
| 5-38-435 | Development of the Superconducting Cavity Maser as a Stable Frequency Source - G.J. Dick and D.M. Strayer                         | 5-41-388 | Shear Mode Transducers for High Q Bulk Microwave Resonators - H.L. Salvo, Jr., M. Gottlieb and B.R. McAvoy                                    |
| 5-39-138 | Phase Noise in Crystal Filters - R.C. Smythe  | 5-41-478 | Review of Dielectric Resonator Oscillator Technology - A.P.S. Khanna  |
| 5-39-159 | A 9.2 GHz Superconducting Cavity Stabilized Oscillator - B. Komiyama  | 5-41-487 | Measurements and Analysis of Cryogenic Sapphire Dielectric Resonators and DRO's - G.J. Dick and D.M. Strayer                                  |
| 5-39-481 | VHF Monolithic Crystal Filters Fabricated by Chemical Milling - R.C. Smythe, M.D. Howard and J.R. Hunt                            | 5-41-503 | The Impact of Digital Signal Processing on Crystal Filter Requirements - M.E. Frerking  |
| 5-39-486 | The Motorola Multi-Pole Monolithic Filter Project - L.N. Dworsky and C.S. Shanley   |          |   |

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- 5-42-95 New Monolithic Crystal Filter with Wide Tabs - Y. Okamoto and H. Sekimoto
- 5-42-101 Semi-Analytical Analysis of Coupled Thickness-Shear and Thickness-Twist in Monolithic Crystal Filters - H. Carru, R. Lefevre, J.P. Aubry and S. LeChopier
- 5-42-106 Performance of TFR Filters Under Elevated Power Conditions - R.S. Ketcham, G.R. Kline and K.M. Lakin
- 5-42-112 Frequency Sorting Based on Planar YIG Resonators - S.M. Hanna and S. Zeroug
- 5-42-217 Analysis of Anharmonics in Surface Skimming Bulk Wave Devices - J.P. Hou
- 5-42-224 Experimental Temperature and Stress Sensitivities of Surface Acoustic Wave Quartz Cuts - E. Bigler, R. Coquerel and D. Hauden
- 5-42-230 An Analysis of the In-Plane Acceleration Sensitivity of ST-Cut Quartz Surface Wave Resonators with the Substrate Extending Beyond the Supports - D.V. Shick and H.F. Tiersten
- 5-42-239 Improved Vibration Sensitivity of the All Quartz Package Surface Acoustic Wave Resonator - J.A. Greer and T.E. Parker
- 5-42-252 SAW Tapped Delay Lines for New Potential Circuit Applications - W.J. Skudera, Jr.
- 5-42-259 Dielectric Resonators (Invited Paper) - P. Guillon
- 5-42-263 Temperature Sensitivity of Dielectric Resonators and Dielectric Resonator Oscillators - M. Loboda, T.E. Parker and G.K. Montress
- 5-42-272 Non-Linear Modeling and Performance of Oscillators Using Thin-Film Bulk-Acoustic Wave Devices - S.G. Burns, P. Thompson and G.R. Kline
- 5-42-284 Temperature Compensation of SAW Oscillators - M. Cracknell, A. Harrison and D. Sharpe
- 5-42-288 Frequency Stability of SAW Oscillators at High Temperatures - B.K. Sinha, Y. Sudo, S. Sato and J. Groves
- 5-42-301 Theory and Design of Low Phase Noise Microwave Oscillators - R. Rogers
- 5-42-364 A Phase-Locked 4-6 GHz Local Oscillator Using Microwave Prescaler - P. Kandpal
- 5-42-369 Low Noise, Microwave Signal Generation Using Bulk and Surface Acoustic Wave Resonators - M.M. Driscoll
- 5-42-378 Low Phase Noise Oscillators Above 1 GHz Utilizing Hermetically Sealed All Quartz Resonators and Harmonic Extraction - C. Chase, R. Laton and C. Yuen



## CATEGORY 6:

### Quartz Crystal Oscillators and Frequency Control Circuitry

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| 6-10-197 | A Frequency Standard at Low Temperature - W.D. George  | 6-14-200 | Quartz Crystal Units and Precision Oscillators for Operation in Severe Mechanical Environments - A.W. Warner, Jr. and W.L. Smith |
| 6-10-268 | The Evaluation of Phase-Stable Oscillators for Coherent Communication System - W.K. Victor                         | 6-14-242 | Effects of Thermal Noise on the Frequency of a Regenerative Oscillator - M.J.E. Golay  |
| 6-10-354 | Design Data for Crystal Oscillators - H.E. Gruen   | 6-14-381 | Development of Quartz Crystal Synthesizers - J.M. Shapiro and W.A. Schultz   |
| 6-10-422 | A Precision Crystal Oven - M.D. McFarlane and R.B. Metz  | 6-14-421 | Frequency and Phase Control of Local Oscillators by Transmitters of Standard Frequency - L. Mooser                               |
| 6-10-470 | The Magnetron Beam Switching Tube as a High Speed Frequency Divider - H. Moss                                      | 6-15-139 | Precision Crystal Frequency Standards - W.J. Spencer and W.L. Smith  |
| 6-10-506 | Change of State Crystal Ovens - E. Snitzer and R. Strong   | 6-15-251 | Frequency Control by Means of a Phase Tracking VLF Receiver - O.J. Baltzer   |
| 6-11-426 | Crystal Oven Developments - M.D. McFarlane   | 6-15-278 | APC with Pulse Reference - T.J. Rey  |
| 6-11-502 | Design Criteria for Vacuum Tube Crystal Oscillators - H.E. Gruen   | 6-15-282 | Design of Low Power Crystal Oven - I.A. Black, A. Everest and T.P. Heuchling   |
| 6-11-518 | Studies on Transistor Crystal Oscillators - E. Eberhard and W.R. McSpadden   | 6-15-297 | A Temperature-Compensated Frequency Standard - G.R. Hykes and D.E. Newell  |
| 6-11-586 | A Portable Frequency Standard - R.L. Craiglow  | 6-16-328 | Multiple-Stage Varactor Harmonic Generators - M.E. Hines, A. Blaisdell, F. Collins, W. Priest, L. Baldwin and S. Johnson         |
| 6-11-614 | Frequency Translator for MASER - S. Schneider  | 6-16-391 | Stability of Tunnel Diode Oscillators - F. Sterzer   |
| 6-12-131 | Fundamental Studies on an Improved Crystal-Controlled Standard - W.L. Smith and A.W. Warner, Jr.                   | 6-16-405 | Precision Quartz Crystal Controlled Oscillator for Severe Environmental Conditions - W.J. Spencer and W.L. Smith                 |
| 6-12-406 | A Precision Delayed Pulse Generator as a Variable Time Interval Standard - D. Hartke, M. Willrodt and D. Broderick | 6-16-422 | Thermoelectric Temperature Control - T.D. Merritts and J.C. Taylor   |
| 6-12-420 | Frequency Multiplication with Phase-Locked Oscillators - H.T. McAleer  | 6-17-482 | Problems of Frequency Multiplication in Atomic Standards - H.D. Guy  |
| 6-13-165 | Tuning Fork Precision Oscillators - H.E. Gruen and O. Colpen   | 6-17-491 | Temperature Compensation of Quartz Crystal Oscillators - D.E. Newell and R.H. Bangert  |
| 6-13-182 | Designing Transistor Oscillator for Crystals - J.H. Sherman, Jr.   | 6-17-508 | Theory of Oscillator Design - E. Hafner  |
| 6-13-191 | Highly Stable Crystal Oscillators for Missile Application - A.W. Warner, Jr. and W.L. Smith                        | 6-17-587 | Frequency Synthesizing Techniques Permitting Direct Control and Rapid Switching - R.R. Stone, Jr. and H.F. Hastings              |
| 6-13-232 | Missile-borne Frequency Standard - H.P. Brower   | 6-18-487 | Advances in Crystal Oscillator and Resonator Compensation - D.E. Newell, H.D. Hinnah and R.H. Bangert                            |
| 6-13-350 | Parametric Frequency Multiplication for Atomic Frequency Standards - R. Rafuse                                     |          |  |
| 6-13-371 | Automatic Phase Lock Frequency Control for Mobile Equipment - J.A. Loutit, R. Story                                |          |  |
| 6-13-566 | A Compact Frequency Translator for Use with the Ammonia MASER - W.K. Saunders                                      |          |  |

# CATEGORY 6 (Cont'd):

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| 6-18-584 | A Frequency Synthesis Technique Using Digital Controlled Division - R.H. Bancroft, Jr. and M.W. Burt             | 6-21-370 | Automated Crystal Oscillator Design - R.L. Craiglow   |
| 6-19-565 | A High Frequency Synthesizer Using Digital Techniques for Economy of Power and Space - J.D. Hill and T.C. Thomas | 6-21-377 | Variable Frequency Voltage Controlled Oscillators Incorporating Quartz Crystal Units - D.J. Healey III                                |
| 6-19-580 | Cubic Inch Frequency Synthesizers - E. Ulicki  | 6-22-298 | Automatic Compensation Equipment for TCXO's - H.D. Hinnah and D.E. Newell   |
| 6-19-617 | Recent Developments in Crystal Oscillator Temperature-Compensation - D.E. Newell, H.D. Hinnah and R.H. Bangert   | 6-22-311 | Recent Improvements to TCXO - P.G. Vovelle  |
| 6-19-642 | The Voltage-Controlled Crystal Oscillator (VCXO), Its Capabilities and Limitations - R.L. Kent                   | 6-22-325 | Temperature Compensation of AT-Cut Crystals by Thermally Controlled Non-Linear Reactances - E.A. Roberts                              |
| 6-19-658 | Warm-Up Characteristics of Oscillators Employing 3 M.C. Fundamental Crystals in HC-27/U Enclosures - R.J. Munn   | 6-22-354 | The LOH Frequency Synthesizer - R.J. Hughes and R.J. Sacha  |
| 6-20-464 | Microminiaturization of Time and Frequency Control Equipments - F. Van Steen and R. Troell                       | 6-23-187 | A Report on Segmented Compensation and Special TCXO's - D.E. Newell and H.D. Hinnah   |
| 6-20-500 | Military Synthesizer Design, Analog and Digital - R.M. Aughey and A. Seipel                                      | 6-23-192 | Temperature-Compensated Crystal-Controlled Oscillators Operating from 800 kHz to 1500 kHz - H.A. Batdorf                              |
| 6-20-501 | Spurious Oscillation in Crystal Oscillators - M.E. Frerking  | 6-23-198 | Frequency Standards for Communications - E.N. LeFevre   |
| 6-20-517 | Generation of Selectable Precise Fractional Frequency Offsets - B. Parzen  | 6-23-201 | Digiphase Frequency Synthesizer - G.C. Gillette   |
| 6-20-544 | Programmed Oscillators for Doppler Radar Systems - G.D. Thompson, Jr. and R.L. Sydnor                            | 6-23-211 | A Miniature Precision Digital Frequency Synthesizer - R.J. Hughes and R.J. Sacha  |
| 6-20-624 | Sidereal Time Standard at the National Radio Astronomy Observatory - C.C. Bare and D.L. Thacker                  | 6-24-191 | Temperature Compensated Crystal Oscillators - P. Duckett, R. Peduto and G. Chizak   |
| 6-20-629 | An Analysis of a Low Information Rate Time Control Unit - L. Fey, J.A. Barnes and D.W. Allan                     | 6-24-200 | New Approach to a High Stability Temperature Compensated Crystal Oscillator - S. Schodowski   |
| 6-21-287 | Vibration Characteristics of Crystal Oscillators - G.F. Johnson  | 6-24-209 | An Ultra Low Noise Direct Frequency Synthesizer - D.G. Meyer  |
| 6-21-294 | Frequency Synthesizers - R.R. Stone, Jr.   | 6-25-231 | The Design and Performance of an Ultra-Pure, VHF Frequency Synthesizer for Use in HF Receivers - M.E. Peterson                        |
| 6-21-308 | RADA Frequency Synthesizer - R.J. Breiding and C. Vammen   | 6-25-240 | The Spectral Frequency Synthesizer - D.R. Lohrmann and A.R. Sills   |
| 6-21-331 | A Low Power, Remotely Controlled Satellite Frequency Standard - M.B. Bloch, J. Ho, I. Math and J. Teitelbaum     | 6-26-43  | Two Stage Self Limiting Series Mode Type Quartz Crystal Oscillator Exhibiting Improved Short-Term Frequency Stability - M.M. Driscoll |
| 6-21-345 | Microminiature Crystal Oscillator - H.P. Thomas, J.H. Sherman, Jr. and R.C. Early                                | 6-26-50  | Low Noise Frequency Multiplication - R.A. Baugh   |

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| 6-26-55  | The Design and Performance of an Ultra Low-Noise Digital Frequency Synthesizer for Use in VLF Receivers - M.E. Peterson  | 6-28-237 | Computer Design and Analysis for High Precision Oscillators J. Ho and R. Nardin                          |
| 6-26-132 | A Temperature Compensated Crystal Oscillator Utilizing Three Crystals - K. Hiram and M. Onoe   | 6-29-248 | Low Noise Microwave Oscillator Design - G. Jerinic, N. Gregory and W. Murphy                             |
| 6-26-140 | Low Power Crystal Oscillator for Electronic Wrist Watch - H. Yoda, H. Ikeda and Y. Yamabe  | 6-29-264 | Aerospace Radar Stalo-Synthesizers - R.C. Kley, Jr.  |
| 6-26-264 | The Disciplined Time/Frequency Standard: A New Multi-Function Crystal Oscillator - D. Babitch, J. Ho and M.B. Bloch  | 6-29-285 | Data Collection Platforms - K.L. Farber  |
| 6-26-279 | Quasiperiodic Frequency Synthesis - G. Becker  | 6-29-294 | An Analysis of Frequency Stability for TCXO - S. Fujii and H. Uchida                                     |
| 6-27-157 | Q-Multiplied Quartz Crystal Resonator for Improved HF and VHF Source Stabilization - M.M. Driscoll   | 6-29-300 | VCXO: Theory and Practice - J. Helle   |
| 6-27-170 | Low Noise UHF Crystal Controlled Source - D.J. Healey III  | 6-30-275 | An Ultra-Stable Low Power 5 Mhz Quartz Oscillator Qualified for Space Usage - J.R. Norton                |
| 6-27-180 | A 500 MHz Low Noise General Purpose Frequency Synthesizer - W.F. Byers, K.W. Craft and G.H. Lohrer   | 6-30-279 | Stable Oscillator for Pioneer Venus Program - M.P. Meirs, T. Robinson and M.B. Bloch                     |
| 6-27-191 | Digitally Compensated TCXO - G.E. Buroker and M.E. Frerking  | 6-30-292 | A Miniature High Stability TCXO Using Digital Compensation - A. Mroch and G.R. Hykes                     |
| 6-27-199 | A Fast Warmup Quartz Crystal Oscillator - H.M. Greenhouse, R.L. McGill and D.P. Clark  | 6-30-301 | Linearization of Direct FM Voltage Controlled Crystal Oscillators - S.J. Lipoff                          |
| 6-27-218 | High Stability Integrator-Controlled Oven for Crystal Oscillators - T. Hamatsuki, H. Uchida and U. Goto  | 6-30-318 | An Efficient Hardware Implementation for High Resolution Frequency Synthesis - B. Bjerde and G.F. Fisher |
| 6-28-181 | The Design and Performance of a Crystal Oscillator Exhibiting Improved Short Term Frequency Stability - J. Gros Lambert, G. Marianneau, M. Olivier and J. Uebersfeld | 6-30-420 | Microwave Frequency Synthesis for Satellite Communications Ground Terminals - G. Mackiw and G. Wild      |
| 6-28-203 | Abnormal Crystal Oscillator Frequency Change with Load Capacitance and its Elimination - S. Nonaka   | 6-31-375 | Ultra-Stable LC Oscillators and Their Applications in Metrology - C.T. Van Degrieff                      |
| 6-28-211 | Compensated Wide Band Voltage Controlled Oscillator for the Viking Program - M.B. Bloch, M.P. Meirs and M. Rosenfeld   | 6-31-385 | Frequency Synthesizers for Airborne Radars - F.W. Hopwood, J.P. Muhlbaier and H. Rossman                 |
| 6-28-214 | Microcircuit Temperature Compensated Crystal Oscillator (MCTCXO) - D.L. Thomann  | 6-31-390 | Frequency Tolerance Limitations with Logic Gate Clock Oscillators - J.D. Holmbeck                        |
| 6-28-221 | New Approach to the Design of Crystal Oscillators - Y. Ohata   | 6-31-396 | The MXO - Monolithic Crystal Oscillator - T. Luxmore and D.E. Newell                                     |
| 6-28-232 | Explicit Expressions for TCXO Design - S.K. Sarkar   | 6-31-400 | Linear Crystal Controlled FM Source for Mobile Radio Application - R. Arakelian and M.M. Driscoll        |
|          |  | 6-31-407 | Design Considerations for a Digitally Temperature Compensated Crystal Oscillator - P.J. Scott            |
|          |  | 6-31-412 | Precision Oscillators Flown on the LES-8/9 Spacecraft - H.S. Babbitt III                                 |

# CATEGORY 6 (Cont'd):

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| 6-31-421 | A Fast Warmup Oscillator for the GPS Receiver - J. Ho and M.B. Bloch  | 6-33-458 | An m/n Frequency Divider Using a Lambda (^) - Shaped Three-Terminal Negative Resistance Device - Y. Sekine, M. Suyama, K. Nakamura, H. Sekine and Y. Sakuta |
| 6-32-102 | Temperature Compensation of Crystals with Parabolic Temperature Coefficients - R.G. Kinsman   | 6-34-52  | Digital Temperature Control for Ultrastable Quartz Oscillators - G. Marianneau and J.J. Gagnepain   |
| 6-32-365 | A General Purpose LSI Frequency Synthesizer System - M.J. Underhill, P.A. Jordan, M.A.G. Clark and R.I.H. Scott   | 6-34-194 | Internal Heating and Thermal Regulation of Bulk Quartz Resonators - J.P. Valentin   |
| 6-32-373 | HF Frequency Synthesizer Adaptive to Various Tuning Time and Frequency Increment Requirements - D.E. Phillips   | 6-34-202 | An L- and S-Band Radar Exciter Using Agile Low Noise Phase Locked Loop Synthesizers - C. Andricos   |
| 6-32-378 | Voltage-Controlled Oscillator with Time-Delay Feedback - J.B.L. Rao and W.M. Water  | 6-34-213 | High Speed, Broadband Tuneable Microwave Synthesizer - E.M. Perdue  |
| 6-32-389 | Dual Mode Operation of Temperature and Stress Compensated Crystals - J.A. Kusters, M.C. Fischer and J.G. Leach  | 6-34-217 | Digital Generation of Wideband Linear FM Waveforms - F.W. Hopwood and R.A. Tracy  |
| 6-32-398 | Temperature Compensation of Crystal Oscillator by Microprocessor - M. Onoe, I. Yamagishi and H. Nariai  | 6-34-233 | UHF Oscillator Using SC Cut Quartz Crystal, with Low Noise Performances and High Long Term Stability - C. Peugeot and G. Sauvage                            |
| 6-32-403 | Highly Precise Standard Signal Circuit for Timepiece - Y. Akahane   | 6-34-449 | Tactical Miniature Crystal Oscillator - H.W. Jackson  |
| 6-32-409 | Mathematical Analysis and Design of an Ultra-Stable Low Noise 100MHz Crystal Oscillator with Differential Limiter and Its Possibilities in Frequency Standards - U.L. Rohde | 6-34-457 | Performance of New Oscillators Designed for "Electrodeless" Crystals - R.J. Besson, D.A. Emmons, P.G. Girardet and E.P. Graf                                |
| 6-32-426 | Improvement in System Performance Using a Crystal Oscillator Compensated for Acceleration Sensitivity - J.M. Przyjemski   | 6-34-463 | A Fast Warmup, SC Cut Crystal Oscillator - M.P. Meirs, P. Sherman, M.B. Bloch and J. Ho   |
| 6-32-549 | Theoretical Performance of Frequency Estimators Using Phase-Locked Loops - T.A. Schonhoff   | 6-34-471 | Requirements and Evaluation of the Circuitry, Excluding the Crystal in Crystal Oscillators - B. Parzen  |
| 6-33-406 | Performance Results of an Oscillator Using the SC Cut Crystal - R. Burgoon and R.L. Wilson  | 6-34-475 | Miniature Packaged Crystal Oscillators - D.M. Embree, R.E. Paradysz, V.R. Saari and R.J. McClure  |
| 6-33-411 | Design Aspects of an Oscillator Using the SC Cut Crystal - R. Burgoon and R.L. Wilson   | 6-34-488 | Direct-Temperature Compensated Crystal Oscillator for Advanced VHF/UHF Radio Communication Systems - S. Okano, T. Mitsuoka and T. Ohshima                   |
| 6-33-417 | An Analysis of Unwanted Frequency Oscillation in a Crystal Controlled Oscillator - S. Kodama and Y. Sato  | 6-34-498 | Integrated Circuit Compensation of AT-Cut Crystal Oscillators - T. Keller, D. Marvin and R. Steele  |
| 6-33-425 | A Non-Iterative Solution for a Two-Thermistor TCXO - C.T. Swanson and E.S. McVey  | 6-34-504 | TCXO Error Due to Aging Adjustment - W.D. Galla and E.S. McVey  |
| 6-33-431 | The Application of Microprocessors to Communications Equipment Design - M.E. Frerking   | 6-35-117 | Reduction of the Effects of Vibration on SC-Cut Quartz Crystal Oscillators - V.J. Rosati and R.L. Filler  |
| 6-33-449 | The Effect of the Sampling Action of Phase Comparators on Frequency Synthesizer Performance - M.J. Underhill and R.I.H. Scott   | 6-35-406 | Direct Digital Frequency Synthesis - A.L. Bramble   |

# CATEGORY 6 (Cont'd):

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|----------|--|----------|---|
| 6-35-415 | A Low Noise 500 MHz Frequency Source - A.I. Vulcan, M.B. Bloch and W.J. Tanski   | 6-37-442 | An Improved Method of Temperature Compensation of Crystal Oscillators - J.S. Wilson   |
| 6-35-428 | Spurious Suppression In Direct Digital Synthesizers - C.E. Wheatley III and D.E. Phillips                                      | 6-37-448 | A New Frequency Temperature Compensation Method for Oscillators - T. Kudo, S. Fujii and S. Nanamatsu                                |
| 6-35-440 | SC-Cut Quartz Crystal Units in Low-Noise Oscillator Application at VHF - D.J. Healey III and S.Y. Kwan                         | 6-37-454 | An Ultra-Stable Crystal Oscillator for Beacons (Program "SARSAT") - A. Stahl and M. Brunet  |
| 6-35-455 | Digital Temperature Compensation of Crystal Oscillators - A.M. Renard and K. Barnhill  | 6-37-459 | Modeling of TTL Inverter Amplifiers as Applied to Overtone Crystal Clock Oscillators - D. Nehring                                   |
| 6-35-492 | Frequency Retrace of Quartz Oscillators - F.K. Euler and N.F. Yannoni  | 6-37-485 | An Analysis of a Microprocessor Controlled Disciplined Frequency Standard - B. Bourke and B. Penrod                                 |
| 6-36-197 | Vibration Compensation of the SEEKTALK Rubidium Oscillator - C. Colson   | 6-37-492 | BVA Quartz Crystal Resonator and Oscillator Production - A Statistical Review - E.P. Graf and U.R. Peier                            |
| 6-36-474 | A Digitally Compensated Hybrid Crystal Oscillator - G.B. Pollard   | 6-37-501 | Temperature Compensated Crystal Oscillator Survey and Test Results - V.J. Rosati, S. Schodowski and R.L. Filler                     |
| 6-36-492 | Update on the Tactical Miniature Crystal Oscillator Program - H.W. Jackson   | 6-38-86  | A Vibration Compensation Scheme for a Tactical Rubidium Oscillator - W. Weidemann   |
| 6-36-499 | Argos System Quartz Device Performance and Orbital Data - M. Geesen, M. Brunet, M.P. Meirs, A. Strauss, J. Ho and M. Rosenfeld | 6-38-315 | Development of a Low "G" Sensitivity Missile Clock - A.I. Vulcan  |
| 6-36-507 | Computer Aided Design and Assembly of Oscillators - T.M. Hall  | 6-38-327 | Balanced Feedback Oscillators - A. Benjaminson  |
| 6-36-562 | Temperature Compensated Crystal Oscillator Panel Discussion - D.E. Newell  | 6-38-334 | Analysis and Design of the Relaxation Quartz Crystal Oscillators - D. Vasiljevic  |
| 6-36-564 | Methods of Temperature Compensation - M.E. Frerking  | 6-38-341 | GPS User Receivers and Oscillators - D. Hessick and W. Euler  |
| 6-36-571 | Dual Mode Digitally Temperature Compensated Crystal Oscillator - R. Rubach   | 6-38-363 | A Time and Frequency Reference System for the Tacamo Aircraft - T.C. Jewell and J.D. Geist  |
| 6-36-576 | A Temperature Compensated SC-Cut Quartz Crystal Oscillator - E.K. Miguel   | 6-38-366 | New Approach of Fast Warm Up for Crystal Resonators and Oscillators - J.P. Valentin, M.D. Decailliot and R.J. Besson                |
| 6-37-87  | Low Phase Noise Multiple Frequency Microwave Source - J.T. Haynes, H. Salvo, R.A. Moore and B.R. McAvoy                        | 6-38-374 | Space Qualified High Performance Digitally Tuned Quartz Crystal Oscillators - R.M. Garvey, D.A. Emmons and A.F. Beaubien            |
| 6-37-91  | Synchronization and Tracking with Synchronous Oscillators - V. Uzunoglu  | 6-38-380 | Manufacturing Methods and Technology for Tactical Miniature Crystal Oscillator - D.A. Brown, E. Laszlo, R.L. McGill and P. Stoermer |
| 6-37-97  | Frequency (Standard) Combiner Selector - V.S. Reinhardt and R.J. Costlow   | 6-39-140 | Designing Crystal Oscillators for Improved Phase-Noise Performance - A. Benjaminson   |
| 6-37-434 | A New Digital TCXO Circuit Using a Capacitor-Switch Array - T. Uno and Y. Shimoda  |          |   |

# CATEGORY 6 (Cont'd)

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| 6-39-166 | Reducing TCXO Error After Aging Adjustment - R.L. Clark   | 6-40-452 | A Rubidium-Crystal Oscillator (RbXO) - W.J. Riley and J.R. Vaccaro  |
| 6-39-176 | Results of Continued Development of the Differential Crystal Oscillator (Computer Analysis of Colpitts' Crystal Oscillator) - T. Adachi, M. Hirose and Y. Tsuzuki     | 6-41-398 | The Acceleration Sensitivity of Quartz Crystal Oscillators: A Review - R.L. Filler  |
| 6-39-189 | A Novel Synthesizer for Miniature SSB Radio Equipment - C.K. Richardson   | 6-41-409 | Suppression of Vibration-Induced Phase Noise in Crystal Oscillators: An Update - V.J. Rosati  |
| 6-39-193 | Hybrid Miniature Oven Quartz Crystal Oscillator - J. Ho   | 6-41-413 | Crystal Oscillators for Airborne Applications - G. Caret, A. Debaisieux, E. Gerard and G. Robichon  |
| 6-39-197 | Low Noise, VHF Crystal-Controlled Oscillator Utilizing Dual, SC-Cut Resonators - M.M. Driscoll  | 6-41-435 | A Digitally Compensated TCXO Using a Single Chip LSI - T. Hara, T. Kudo, S. Uriya, H. Saita, S. Ogou and Y. Katsuta   |
| 6-39-202 | A Satellite Oscillator for Very Precise Orbitography: The Doris Program - A. Debaisieux, J.P. Aubry, E. Gerard and M. Brunet  | 6-41-439 | Analysis of High Performance Compensated Thermal Enclosures - F.L. Walls  |
| 6-39-212 | An Oscillator for the GPS Program - G. Marotel, G. Caret and J.P. Aubry   | 6-41-452 | The Design and Analysis of VHF/UHF Crystal Oscillators - A. Benjaminson   |
| 6-40-292 | Fast Channelizer - A New Frequency Sorting Technique - J.H. Elliott, R.B. Stokes and K.H. Yen   | 6-41-460 | CMOS Gate Oscillator Design - T.B. Mills  |
| 6-40-325 | A Frequency Adjustable Ultra-Compact, High-Performance Quartz Crystal Oscillator and Its Simple Temperature Compensation Method - O. Ochiai, F. Tamura and Y. Mashimo | 6-41-492 | Compact and Simple x 3 (9 to 27 GHz) PLL Frequency Multiplier Using Harmonic Phase Detection - J. Berenguer, J. Bara and A. Comeron   |
| 6-40-329 | Low Noise Crystal Oscillators Using 50-OHM, Modular Amplifier Sustaining Stages - M.M. Driscoll   | 6-41-495 | An Analysis of the Output Spectrum of Direct Digital Frequency Synthesizers in the Presence of Phase-Accumulator Truncation - H.T. Nicholas III and H. Samuelli                 |
| 6-40-340 | Digital Temperature Compensation of Crystal Oscillators Using Temperature Switches - Z. Aleksic, D. Vasiljevic and A. Pavasovic                                       | 6-41-512 | Low Noise Frequency Synthesis - F.L. Walls and C.M. Felton  |
| 6-40-344 | A Crystal Oscillator with Bidirectional Frequency Control and Feedback ALC - A. Benjaminson   | 6-41-519 | Low Noise Airborne Synthesizer for Frequency Agile Radar - A.I. Vulcan and M.B. Bloch   |
| 6-40-350 | Integrated Oven Controlled Quartz Crystal Oscillator - G. Marianneau, D. Hauden and J.J. Gagnepain  | 6-41-524 | Improvement of the Pull-In Range and Acquisition Time of a Microwave P.L.L System by Injection Locking the V.C.O. - J. Berenguer, J. Bara, E. Artal, I. Corbella and A. Comeron |
| 6-40-355 | A Short Survey of Frequency Synthesizer Techniques - V.S. Reinhardt, K. Gould, K. McNab and M. Bustamante   | 6-41-539 | High Frequency Stable Frequency Sources for Advanced Systems - A. Harrison, J. Dowsett and D. Sharpe  |
| 6-40-366 | Army Frequency Agile Synthesizer Program - A.L. Bramble and J. Kesperis   | 6-42-276 | A Wide Frequency Range, Surface Mountable, Voltage Controllable Crystal Oscillator Family - S. Logan, D.M. Embree, R. Sheehey and D.S. Stevens                                  |
| 6-40-370 | SOS Frequency Synthesizer Development - D.P. O'Rourke   | 6-42-327 | A New Digitally Temperature Compensated Crystal Oscillator for a Mobile Telephone System - T. Miyayama, Y. Ikeda and S. Okano   |
| 6-40-373 | Performance Analysis of the Numerically Controlled Oscillator - E.C. Kisenwether and W.C. Troxell   |          |   |

CATEGORY 6 (Cont'd):

- 6-42-334 An Acceleration Compensated  
Precision Quartz Oscillator - B.T.  
Milliren, D. Martin and D.A. Emmons
- 6-42-342 The Relaxation Quartz Crystal  
Oscillators - Design & Performances  
- D. Vasiljevic
- 6-42-348 Clarification and a Generalized  
Restatement of Leeson's Oscillator  
Noise Model - B. Parzen
- 6-42-352 Phase Noise in Direct Digital  
Synthesizers - E.M. Mattison, L.  
Coyle
- 6-42-357 The Optimization of Direct Digital  
Frequency Synthesizer Performance in  
the Presence of Finite Word Length  
Effects - H.T. Nicholas III, H.  
Samueli and B. Kim

## CATEGORY 7:

### Quantum Electronic Frequency Standards (Microwave Frequencies)

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|----------|--|----------|---|
| 7-10-259 | Atomic and Molecular Frequency Standards - R.H. Dicke  | 7-13-309 | Broken Beam Experiment at Harvard University - D. Kleppner                                      |
| 7-11-307 | Rubidium Oscillator Experiments - T.R. Carver  | 7-13-546 | Missile-borne MASER - F.H. Reder and C.J. Bickart   |
| 7-11-318 | Optical Pumping, Buffer Gases and Walls - W.B. Hawkins                                       | 7-13-575 | Gas MASER for Frequency Control - J.F. Lotspeich and M.L. Stitch                                |
| 7-11-324 | Hot Sources for MASER - M.W.P. Strandberg  | 7-13-583 | MASER Frequency Stability - J.A. Barnes and R. Mockler  |
| 7-11-335 | MASER Progress and Phase Lock Techniques - F.O. Vonbun and G.M.R. Winkler                    | 7-13-596 | Ammonia MASER Work at Bell Telephone Laboratories - L.D. White                                  |
| 7-11-352 | MASER Engineering at Jet Propulsion Laboratory - W. Higa                                     | 7-13-603 | MASERS With Slow Molecules - J.G. King  |
| 7-11-373 | Precision Atomic Beam Techniques - P. Kusch  | 7-13-604 | Suitable Molecules for Utilizing MM-Wave Transitions for Frequency Control - J.J. Gallagher     |
| 7-11-385 | Performance of Cesium Beam Standards and Future R&D Plans - F.H. Reder and S.H. Roth         | 7-13-618 | MASER Laboratory Frequency Standard - F.O. Vonbun   |
| 7-12-517 | Progress in MASER Work at USASEL - F.H. Reder  | 7-13-632 | Triple Resonance Method to Achieve Narrow and Strong Spectral Lines - C. Alley                  |
| 7-12-534 | Measurement of MASER Frequency in Terms of Cesium Standard - G.M.R. Winkler                  | 7-13-648 | Gas Cell Frequency Standards Using Buffer Gases and Buffer Walls - R. Whitehorn                 |
| 7-12-538 | MASER Research at Neuchatel University, Switzerland - J. Bonanomi                            | 7-13-655 | Evaluation of ITT Breadboard Gas Cell Frequency Standard - M. Arditi                            |
| 7-12-551 | Beam MASER Techniques - W.H. Higa  | 7-13-668 | Hyperfine Transitions in Rubidium 87 Vapor - E.C. Beaty, P.L. Bender and A.R. Chi               |
| 7-12-569 | A Sealed-Off MASER - S. Johnson  | 7-13-676 | Gas Cell Work at the Space Technology Laboratories - D.J. Farmer, J.M. Andres and G.I. Inouye   |
| 7-12-577 | Realization and Measurement of Long Free Atom Spin State Lifetimes - H. Dehmelt              | 7-13-683 | Study of the Spin Relaxation of Optically Aligned Rubidium Vapor - W. Franzen                   |
| 7-12-593 | Optical Detecting of Cesium Hyperfine Transition - P.L. Bender, E.C. Beaty and A.R. Chi      | 7-14-250 | Work on Atomic Frequency Standards at the Nat'l Physical Laboratory during 1959-1960 - L. Essen |
| 7-12-606 | Gas Cell "Atomic Clocks" Using Buffer Gases and Optical Orientation - M. Arditi              | 7-14-261 | A Superior Atomic Clock for Continuous Long Time Operation - G.M.R. Winkler                     |
| 7-12-625 | Discussion of Some Limits of Atomic Frequency Control - T.R. Carver                          | 7-14-298 | NBS Atomic Frequency Standards - R. Mockler and R.E. Beehler                                    |
| 7-12-632 | Design Considerations of Atomic Beam Frequency Standards for Missile Environment - R.T. Daly | 7-14-310 | Molecular Beam Devices with Storage Boxes - N.F. Ramsey, D. Kleppner and H.M. Goldenberg        |
| 7-13-266 | Atomic Beam Work at the National Physical Laboratory during 1958-1959 - L. Essen             | 7-14-315 | Missile-borne Atomicron Frequency Standard - A.O. McCoubrey                                     |
| 7-13-276 | National's Militarized Cesium Beam Frequency Standards - A.O. McCoubrey                      | 7-14-328 | Effect of Molecular Frequency Spread on Emission Cavities - I.R. Senitzky                       |
| 7-13-297 | TRG Missile-borne Cesium Beam Standard - R.T. Daly   |          |   |



# CATEGORY 7 (Cont'd):

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| 7-14-329 | Frequency Shifts of Microwave Resonance in a Gas Cell Using Optical Pumping - M. Arditi and T.R. Carver                        | 7-17-176 | Application of Superconductivity to Frequency Control - W. Hartwig   |
| 7-14-330 | Design Considerations for a Self-Contained Ammonia Maser Oscillator - S. Hopfer  | 7-17-329 | Achievements and Problem Areas of Atomic Frequency Control - F.H. Reder  |
| 7-14-354 | Description of a Long Cesium Beam Frequency Standard - P. Kartaschoff, J. Bonanomi and J. DePrins                              | 7-17-372 | Frequency Beat Experiments with Hydrogen Masers - R.F.C. Vessot and H.E. Peters                                      |
| 7-15-156 | The Atomic Clock as a Phase-Stable Oscillator for Deep Space Communication - L. Malling  | 7-17-392 | Experimental Evaluation of a Thallium Beam Frequency Standard - R.E. Beehler and D.J. Glaze                          |
| 7-15-168 | Frequency Control of NBA on an International System (II) - W.M. Markowitz and R.G. Hall  | 7-17-408 | Recent Developments in the Field of Atomic Frequency and Time Standards in Switzerland - J. Bonanomi                 |
| 7-15-180 | The Atomic Hydrogen Maser - N.F. Ramsey  | 7-17-409 | Excitation of Millimeter Wave Transitions for Frequency Control - R.G. Strauch, R.E. Cupp and J.J. Gallagher         |
| 7-15-181 | Frequency Control by Gas Cell Standards -- Fundamental Problems in the Light of Recent Experimental Results - M. Arditi        | 7-17-438 | Development and Performance of a Miniaturized Cesium Beam Tube - J. George   |
| 7-15-203 | The Ultimate Signal to Noise Possibilities of a Maser - I.R. Senitzky  | 7-17-449 | Performance and Application of Gas Cell Frequency Standards - D.J. Farmer  |
| 7-15-204 | Choice of a Molecular Transition for Frequency Control in the Millimeter Wave Region - F. Barnes, D. Burkhard and M. Mizushima | 7-17-462 | Report on the Frequency of Hydrogen - W.M. Markowitz   |
| 7-15-210 | Deuterated Ammonia Submillimeter Maser - A Progress Report - V.E. Derr, J.J. Gallagher and M. Lichtenstein                     | 7-18-265 | A Discussion of the Properties of Four Molecular Beam Detectors - F. Barnes, S.G. Andresen, C. Shipley and D. Foiani |
| 7-16-256 | Advances in CW Solid State Optical Masers - C.G.B. Garrett   | 7-18-283 | Hydrogen Maser Work at USAEL - H.G. Andresen and C.J. Bickart  |
| 7-16-257 | Frequency Characteristics of an Optical Maser - A. Javan and T.S. Jaseja   | 7-18-299 | Recent Developments in Hydrogen Masers - R.F.C. Vessot, H.E. Peters and J. Vanier                                    |
| 7-16-258 | Spectral Distribution of Induced and Spontaneous Emission by a Molecular Beam in a Cavity - I.R. Senitzky                      | 7-18-308 | The NPL Frequency Standard - L. Essen, J. McA. Steele and D.S. Sutcliffe   |
| 7-16-259 | Comparison of Performance Criteria of Frequency Standards - C.L. Searle and D.A. Brown   | 7-18-322 | Recent Developments for Cesium Beam Resonators - J. George, E. Wunderer and T. Athanis                               |
| 7-16-267 | Theory of Resonance Frequency Shift Due to the Radiation Field - M. Mizushima  | 7-18-344 | A Modern Solid State Portable Cesium Beam Frequency Standard - A.S. Bagley and L.S. Cutler                           |
| 7-16-287 | The Atomic Hydrogen Maser - N.F. Ramsey  | 7-18-366 | Progress in the Development of a Cesium Beam Oscillator for Aerospace Guidance - J.H. Holloway and R.H. Woodward     |
| 7-16-305 | Generation of Phase-Locked Millimeter Waves for Frequency Control - R.G. Strauch, R.E. Cupp, J.W. Dees and J.J. Gallagher      | 7-18-384 | Electronic Circuits for Tri-Service Cesium Beam Frequency Standard - A. Orenberg                                     |
|          |  | 7-19-298 | A Militarized Solid State Cesium Beam Frequency Standard - S. Fast, J. George, G. Simpson and C. Lydiard             |

# CATEGORY 7 (Cont'd):

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| 7-19-332 | Long Time Constant Servo System for Cesium Beam Frequency Standard - H. Daams and A.G. Mungall  | 7-20-448 | Performance Characteristics of a Portable Cesium Beam Standard - L.N. Bodily   |
| 7-19-344 | Characteristics of a High Performance Cesium Beam Frequency Standard - J.H. Holloway and R. Sanborn   | 7-21-467 | Molecular and Atomic Beam Geometry Optimization - J. DePrins, P.J. Wauters and S.G. Andresen   |
| 7-19-369 | Line Width Investigation of Millimeter Electric Resonance Molecular Beam Transitions - R.G. Strauch, R.E. Cupp, V.E. Derr and J.J. Gallagher  | 7-21-483 | A New Cesium Beam Resonator - J. George  |
| 7-19-385 | Methods and Results for Reducing Cavity Pulling Effects of the Hydrogen Maser Frequency - H.G. Andresen                                       | 7-21-484 | A Proposed Barium Oxide Molecular Beam Frequency Standard - H. Hellwig   |
| 7-19-402 | A Comparison of Performance Characteristics of Hydrogen, Rubidium and Ammonia Masers - R.F.C. Vessot, J. Vanier, H.E. Peters and L.F. Mueller | 7-21-491 | Determination of the Tl205 Ground State hfs Transition Frequency - R.F. Lacey  |
| 7-19-416 | Large Storage Bulb for Hydrogen Frequency Standard - N.F. Ramsey  | 7-21-500 | Recent Developments in Atomic Hydrogen Masers - N.F. Ramsey  |
| 7-19-417 | The Effects of Optical Pumping on the Rb87 Maser Oscillator - P. Davidovits and W.A. Stern  | 7-21-543 | Atomic Hydrogen Maser Work at L.S.R.H., Neuchatel, Switzerland - C. Menoud, J. Racine and P. Kartaschoff   |
| 7-20-364 | On the Power Output of the Optically Pumped Rb87 Maser - J. Vanier  | 7-21-568 | Recent Development on the Rubidium 87 Maser - J. Vanier  |
| 7-20-365 | High-Power Maser Atomic Frequency Standards - R. Novick, W. Happer and W.A. Stern   | 7-22-452 | Large Storage Box Hydrogen Maser - E.E. Uzgiris and N.F. Ramsey  |
| 7-20-370 | Stark-Filtered Intensity-Pumped Maser Atomic Frequency Standards - W.A. Stern, W. Happer and R. Novick  | 7-22-464 | Hydrogen Standard Work at Goddard Space Flight Center - H.E. Peters, T.E. McGunigal and E.H. Johnson   |
| 7-20-377 | Millimeter and Submillimeter Wave Molecular Beam Investigations - J.J. Gallagher, R.E. Cupp and R.A. Kempf                                    | 7-22-493 | Application of the Transient Behavior to the Study of the Hydrogen Maser - C. Audoin, M. Desaintfuscién and J.P. Schermann                       |
| 7-20-387 | Recent Developments in Hydrogen Masers - N.F. Ramsey  | 7-22-517 | Some Experimental Results of BaO Applicable to a Molecular Beam Frequency Standard - S.G. Andresen, H.O. Mortelmans, P.J. Wauters and J. DePrins |
| 7-20-389 | Studies of Field Effect Transistors for Use in Atomic Beam Tube Detectors - J.H. Holloway and P. Penfield, Jr.                                | 7-22-529 | Barium Oxide Beam Tube Frequency Standard - H. Hellwig, R. McKnight, E. Pannaci and G. Wilson  |
| 7-20-402 | Servo-Controlled Hydrogen Maser Cavity Tuning - H.G. Andresen and E. Pannaci  | 7-22-545 | Phase Shift in Microwave Ramsey Structures - R.F. Lacey  |
| 7-20-416 | A Thallium Atomic Beam Tube for Frequency Control - R.F. Lacey  | 7-22-559 | Study of Phenomena Affecting the Composition of Rubidium Vapor Cells - M.P.R. Thomsen, L.J. Stief and R.J. Fallon                                |
| 7-20-424 | Some Accuracy Limiting Effects in an Atomic Beam Frequency Standard - R.J. Harrach  | 7-22-573 | Extension of Frequency Control Techniques to the Submillimeter Wavelength Region - R.A. Kempf, R.E. Cupp, W.T. Smith and J.J. Gallagher          |
| 7-20-436 | The Canadian Cesium Beam Frequency Standard - A.G. Mungall, H. Daams and R. Bailey  | 7-22-605 | Progress in the Development of Hydrogen Masers - M. Baker, M.W. Levine, L.F. Mueller and R.F.C. Vessot   |

# CATEGORY 7 (Cont'd):

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| 7-23-263 | Light Modulation at the Rb <sup>87</sup><br>Hyperfine Frequency - H. Tank and W. Happer   | 7-25-46  | History of Atomic and Molecular<br>Control of Frequency and Time - N.F. Ramsey   |
| 7-23-271 | An Optically Pumped Rb <sup>85</sup> Maser<br>Frequency Standard - W.A. Stern and R. Novick   | 7-25-297 | Cesium Atomic Beam Frequency<br>Standards - R.E. Beehler   |
| 7-23-274 | A Report on the Performance<br>Characteristics of a New Rubidium<br>Vapor Frequency Standard - D.H. Throne  | 7-25-309 | Frequency Biases in a Beam Tube<br>Caused by Ramsey Cavity Phase<br>Differences - H. Hellwig, J.A. Barnes and D.J. Glaze   |
| 7-23-279 | Improved State Selection for<br>Hydrogen Masers - R.F. Lacey and R.F.C. Vessot  | 7-25-313 | Performance of Newly Developed<br>Cesium Beam Tubes and Standards - R. Hyatt, D.H. Throne, L.S. Cutler, J.H. Holloway and L.F. Mueller   |
| 7-23-284 | Recent Results Concerning the<br>Hydrogen Maser Wall Shift Problem - E.E. Uzgiris and P.W. Zitzewitz  | 7-25-325 | A Field Independent Optically Pumped<br>Rb <sup>85</sup> Maser Frequency Standard - W.A. Stern and R. Novick   |
| 7-23-288 | A New Method for Measurement of the<br>Population Difference of Hyperfine-<br>Levels of Stored Atoms - C. Audoin, M. Desaintfuscien, P. Piejus and J.P. Schermann | 7-25-331 | Miniaturized Rapid Warm Up Rubidium<br>Frequency Source - M.M. Zepler  |
| 7-23-297 | Atomic Hydrogen Standards for NASA<br>Tracking Stations - H.E. Peters, T.E. McGunigal and E.H. Johnson  | 7-25-337 | Discussion of Cavity Pulling in<br>Passive Frequency Standards - J. Viennet, C. Audoin and M. Desaintfuscien   |
| 7-24-246 | Areas of Promise for the Development<br>of Future Primary Frequency<br>Standards - H. Hellwig   | 7-25-343 | Hydrogen Maser Wall Shift<br>Experiments at the Nat'l Research<br>Council of Canada - D. Morris  |
| 7-24-259 | Hydrogen Maser with Deformable<br>Storage Bulb - P.E. Debely  | 7-25-348 | Hydrogen Maser Frequency Standard - C. Finnie, R.L. Sydnor and A. Sward  |
| 7-24-263 | Surface Collision Frequency Shifts<br>in the Atomic Hydrogen Maser - P.W. Zitzewitz   | 7-26-202 | Joseph H. Holloway (1929-1971) -<br>Twenty Years of Progress in Atomic<br>Frequency Standards - A.O. McCoubrey and L.S. Cutler   |
| 7-24-270 | Studies of Hydrogen Maser Wall Shift<br>for High Molecular Weight<br>Polytetrafluorethylene - R.F.C. Vessot and M.W. Levine                                       | 7-26-211 | Automatic Frequency Controlled<br>Rubidium Frequency Standard - Y. Sato, H. Kumamoto, H. Oyamada and H. Uchida   |
| 7-24-279 | New Information on the Physics of<br>Rubidium Gas Cells - P.L. Bender and V.W. Cohen  | 7-26-216 | Rubidium Frequency and Time Standard<br>for Military Environment - M.E. Frerking and D.E. Johnson  |
| 7-24-280 | Progress Report on the Rubidium 85<br>Maser - J. Vanier, R. Vaillancourt, G. Missout and M. Tetu  | 7-26-223 | Further Results on the Rubidium-87<br>Maser Frequency Standard - W.A. Stern and R. Novick  |
| 7-24-285 | An Optically Pumped Parametric<br>Frequency Converter - H. Tang and W. Happer   | 7-26-225 | Short Term Stability of Rb <sup>87</sup> Maser - M. Tetu and J. Vanier   |
| 7-24-294 | Cesium Beam Servo System Using<br>Square Wave Frequency Modulation - H. Daams   | 7-26-230 | Hydrogen as an Atomic Standard - H.E. Peters   |
| 7-24-308 | New Primary Cesium Beam Frequency<br>Standard - F. Kupersmith, C. Thornburg and J. Ho   | 7-26-242 | Experimental Results with Atomic<br>Hydrogen Storage Beam Systems - H. Hellwig and H.E. Bell   |
| 7-24-361 | The NBS Atomic Time Scale System:<br>AT(NBS), SAT(NBS), and UTC(NBS) - D.W. Allan, J.E. Gray and H.E. Machlan   | 7-26-248 | Precision Absolute Frequency and<br>Wavelength Measurements in the<br>Infrared: A Review of Activities at<br>MIT - J.G. Small, J.P. Monchalin, M.J. Kelly, F. Keilmann, A. Sanchez, S.K. Singh, N.A. Kurnit and A. Javan |

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| 7-26-319 | Absolute Frequency of an Atomic Hydrogen Maser Clock - E.E. Peters, R.G. Hall and D.B. Percival   | 7-28-362 | Preliminary Research and Development of the Cesium Tube Accuracy Evaluation System - D.A. Howe, H.E. Bell and H. Hellwig                     |
| 7-27-317 | A Preliminary Report on Cs V, New NRC Long-Beam Primary Frequency and Time Standard - A.G. Mungall, R. Bailey, H. Daams, D. Morris and C.C. Costain   | 7-28-401 | Satellite Application of a Rubidium Frequency Standard - S.A. Nichols and J.D. White   |
| 7-27-334 | Some Performance Data for the Standards in the National Bureau of Standards Atomic Time Scale System - D.W. Allan, D.J. Glaze, H.E. Machlan, A.E. Wainwright, H. Hellwig, J.A. Barnes and J.E. Gray | 7-29-352 | A New Compact Cesium Beam Frequency Standard - E.P. Graf, L.F. Johnson and R.A. Kern   |
| 7-27-347 | Recent Progress on the NBS Frequency Standards - D.J. Glaze, H. Hellwig, S. Jarvis, Jr. and A.E. Wainwright   | 7-29-357 | An Improved Method for Measuring the Magnetic Inhomogeneity Shift in Hydrogen Masers - V.S. Reinhardt and H.E. Peters                        |
| 7-27-357 | Time Domain Velocity Modulation as a Tool to Evaluate Cesium Beam Tubes - H. Hellwig, S. Jarvis, Jr., D.J. Glaze, D. Halford and H.E. Bell  | 7-29-362 | The Concertina Hydrogen Maser - H.E. Peters  |
| 7-27-367 | Developments of Hydrogen Masers as Frequency Standards at Orsay - P. Petit, J. Viennet, R. Bartillet, M. Desaintfuscien and C. Audoin   | 7-29-371 | The Hydrogen Maser Wall Shift Problem - J. Vanier, R. Larouche and C. Audoin   |
| 7-27-387 | A New Miniature Rubidium Gas Cell Frequency Standard - E. Jechart   | 7-29-383 | Theoretical and Experimental Studies of Some Problems Related to the Passive Rubidium Gas Cell Frequency Standard - G. Missout and J. Vanier |
| 7-27-390 | Evaluation of a Rubidium Standard for Satellite Application - R.B. Moore, S.A. Nichols and J.D. White   | 7-29-387 | A Digital 5.00688 MHz Synthesizer and Squarewave FM Servo System for Cesium Standards - D.A. Howe and H.F. Salazar                           |
| 7-27-400 | Cavity Tuning and Light Shift in the Rb87 Maser - G. Busca, M. Tetu and J. Vanier   | 7-30-414 | A Heuristic Model of Long-Term Atomic Clock Behaviour - D.B. Percival  |
| 7-27-404 | Status of the Development of the Rubidium-87 Maser Frequency Standard - W.A. Stern, E. Aulich and R. Novick   | 7-30-451 | Velocity Distribution Measurements of Cs Beam Tubes - D.A. Howe  |
| 7-28-247 | Atomic Frequency Standard Relativistic Doppler Shift Experiment - H.E. Peters and V.S. Reinhardt  | 7-30-457 | Performance of a Dual Beam High Performance Cesium Beam Tube - G. Seavey and L.F. Mueller  |
| 7-28-315 | Atomic Frequency Standards, A Survey - H. Hellwig   | 7-30-463 | Measured Performance and Environmental Sensitivities of a Rugged Cesium Beam Frequency Standard - M.C. Fischer and C.E. Heger                |
| 7-28-340 | A Consideration of Rubidium Lamp Stability for Rubidium Frequency Standard - H. Oyamada, K. Takahashi, Y. Sato and H. Uchida  | 7-30-468 | Optimization of the Buffer Gas Mixture for Optically Pumped Cs Frequency Standards - F. Strumia, N. Beverini, A. Moretti and G.D. Rovera     |
| 7-28-344 | A Compact Rb <sup>87</sup> Maser - G. Busca, J. Racine and J. Vanier  | 7-30-473 | A New Kind of Passively Operating H-Frequency Standard - F.L. Walls and H. Hellwig   |
| 7-28-350 | Mg Frequency Standard: Optimization of the Metastable Atomic Beam - F. Strumia, P. Minguzzi, M. Francesconi and R. Benedetti  | 7-30-481 | NASA Atomic Hydrogen Frequency Standards Program - An Update - V.S. Reinhardt, D.C. Kaufman, W.A. Adams, J.J. DeLuca and J.L. Soucy          |
| 7-28-355 | Density-Dependent Shifts of Hydrogen Maser Standards - S.B. Crampton and H.T.M. Wang  | 7-30-489 | A Study to Identify Hydrogen Maser Failure Modes - A.E. Popa, H.T.M. Wang, W.B. Bridges, A.N. Chester, J.E. Etter and B.L. Walsh             |

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| 7-31-510 | Design of a Spacecraft Hydrogen Maser - E.S. Sabisky and H.E. Peters  | 7-32-492 | A Passive Hydrogen Maser Frequency Standard - F.L. Walls and D.A. Howe   |
| 7-31-520 | Hydrogen Maser with a Double Configuration Bulb for Wall Shift Measurements in the Temperature Range 25-120°C - P. Petit, M. Desaintfuscien and C. Audoin                 | 7-32-499 | An Operating Development Model Spcaeacraft Hydrogen Maser - E.S. Sabisky and H.A. Weakliem   |
| 7-31-525 | A New Generation of SAO Hydrogen Masers - M.W. Levine, R.F.C. Vessot, E.M. Mattison, G.U. Nystrom, T. Hoffman and E.L. Blomberg   | 7-32-506 | Effect of Line Inhomogeneity on the Frequency of Passive Rb <sup>87</sup> Frequency Standards - A.S. Risley and G. Busca   |
| 7-31-535 | Zeeman Effects on H and Rb Masers - G. Busca, J.Y. Savard, S. Rovea, J. Vanier, M. Desaintfuscien, P. Petit and C. Audoin   | 7-32-531 | Analysis of H-Maser Autotuning Systems - C. Audoin, P. Lesage, J. Viennet and R. Barillet  |
| 7-31-542 | Development of a Cesium Beam Clock for Satellite Application - J. George and A.I. Vulcan  | 7-32-560 | NTS-2 Cesium Frequency Stability Results - T.B. McCaskill, J.D. White, S. Stebbins and J.A. Buisson  |
| 7-31-551 | New Cesium Beam Frequency Standards for Flight and Ground Applications - T.K. Gregory   | 7-33-477 | Study of the Dependence of Frequency Upon Microwave Power of Wall-Coated and Buffer-Gas-Filled Passive Rb <sup>87</sup> Frequency Stanards - A.S. Risley, S. Jarvis, Jr. and J. Vanier |
| 7-31-555 | Some Causes and Cures of Frequency Instabilities (Drift and Noise) in Cesium Beam Frequency Standards - D.W. Allan, H. Hellwig, S. Jarvis, Jr., D.A. Howe and R.M. Garvey | 7-33-484 | Development of a Light Weight, Military, Cesium Standard - I. Pascaru and M.P. Meirs   |
| 7-31-562 | Results with Special-Purpose Ammonia Frequency Standard - D.J. Wineland, D.A. Howe and M.B. Mohler  | 7-33-490 | New Cesium Beam Tube Utilizing Hexapole / Double-Dipole Optics - D.A. Emmons and P.J. Rogers   |
| 7-32-444 | Analysis of New Microwave and Optical Frequency Standards Based on Ions Storage - F. Strumia  | 7-33-511 | Research With a Cold Atomic Hydrogen Maser - R.F.C. Vessot, E.M. Mattison and E.L. Blomberg  |
| 7-32-453 | New Possibilities for Frequency Standards Using Laser Cooling and Detection of Stored Ions - F.L. Walls, D.J. Wineland and R.E. Drullinger                                | 7-33-515 | Amplitude Noise in Passively and Actively Operated Masers - P. Lesage, C. Audoin and M. Tetu   |
| 7-32-460 | A New Voltage, Maintenance-Free, Cesium Beam Tube for a Frequency Standard - H. Jumonji, K. Tanaka, J. Toyama, H. Takoaka, K. Kariya and J. Kawada                        | 7-33-536 | Hydrogen Frequency Standard Using Free-Induction Technique - H.T.M. Wang   |
| 7-32-466 | Parameters Affecting the Stability of an Optically Pumped Cesium Frequency Standard - G.D. Rovera, S. Leschiutta, G. Busca and F. Strumia                                 | 7-33-543 | Compact Cavity for Hydrogen Frequency Standard - H.T.M. Wang, J.B. Lewis and S.B. Crampton   |
| 7-32-469 | Small, Very Small, and Extremely Small Hydrogen Masers - H.E. Peters  | 7-33-549 | Design, Construction and Testing of a Small Passive Hydrogen Maser - E.M. Mattison, E.L. Blomberg, G.U. Nystrom and R.F.C. Vessot  |
| 7-32-477 | Performance Evaluation of the SAO VLG-11 Atomic Hydrogen Masers - M.W. Levine, R.F.C. Vessot and E.M. Mattison  | 7-33-554 | A Small Passively Operated Hydrogen Maser - D.A. Howe, F.L. Walls, H.E. Bell and H. Hellwig  |
| 7-32-486 | NASA NR Hydrogen Maser - L.J. Rueger, A.G. Bates, L. Stillman, J. Norton, C.M. Blackburn and V.A. Reinhardt   | 7-33-563 | "Passive H Maser" - G. Busca and H. Brandenberger  |
|          |   | 7-34-320 | Longevity Performance of Cesium Beam Frequency Standards - A.C. Johnson, M.M. Force and T.N. Osterdock   |
|          |   | 7-34-353 | Mercury Ion Frequency Standard: Preliminary Results - M. Jardino, M. Desaintfuscien, R. Barillet, J. Viennet, P. Petit and C. Audoin   |

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| 7-34-360 | New Hydrogen Maser Designs - H.E. Peters   | 7-36-255 | The Development of a Magnetically Enhanced Hydrogen Gas Dissociator - L. Maleki  |
| 7-34-364 | An Oscillating Compact Hydrogen Maser - H.T.M. Wang  | 7-36-260 | Preliminary Measurements on EFOS 1 H Maser - G. Busca, F. Addor, F. Hadorn, G. Nicolas, L. Prost, H. Brandenberger, P. Thomann and L.F. Johnson                |
| 7-34-370 | Results of the Development of the Light Weight Cesium Standard - M.P. Meirs, I. Pascaru and M.B. Bloch   | 7-36-340 | Short-Term Frequency Stability and Systematic Effects on the Rubidium 87 Maser Oscillator Frequency - M. Tetu, P. Tremblay, D. Bonnier and J. Vanier           |
| 7-34-376 | Possible Avenues of Improvement of the Short and Long Term Stability of Optically Pumped Passive Rubidium Frequency Standards - L.G. Bernier, A. Brisson, M. Tetu, J.Y. Savard and J. Vanier | 7-36-348 | On the Lightshift and Buffer Gas Shift in Passive Rubidium Frequency Standards - J. Vanier, R. Kunski, P. Paulin, J.Y. Savard, M. Tetu and N. Cyr              |
| 7-35-602 | Proposed Stored $201\text{Hg}^+$ Ion Frequency Standards - D.J. Wineland, W.M. Itano, J.C. Bergquist and F.L. Walls  | 7-37-5   | History of Atomic Frequency Standards - N.F. Ramsey  |
| 7-35-612 | Optical Pumping by Lasers in Atomic Frequency Standards - L.L. Lewis and M. Feldman  | 7-37-6   | Pulsars: Nature's Most Precise Clocks - J.H. Taylor  |
| 7-35-625 | Preliminary Investigation of a New Optically Pumped Atomic Rubidium Standard - M. Feldman, J.C. Bergquist, L.L. Lewis and F.L. Walls   | 7-37-7   | Application of Metal Hydrides for Gas Handling in Hydrogen Masers - H.T.M. Wang  |
| 7-35-637 | Development of a Sapphire Lamp for Use in Satellite-borne Atomic Rubidium Clocks - T.C. English and E. Jechart   | 7-37-12  | Compact Rectangular Cavity for Rubidium Vapor Cell Frequency Standards - H.E. Williams, T.M. Kwon and T. McClelland  |
| 7-35-646 | A Miniature, High-Performance Rubidium Frequency Standard - T. Hashi, K. Chiba and C. Takeuchi   | 7-37-18  | Improved Vibration Performance in Passive Atomic Frequency Standards by Servo-Loop Control - T.M. Kwon and T. Hahn   |
| 7-35-651 | Performance of the GPS Cesium Beam Frequency Standard in Orbit - M.W. Levine   | 7-37-21  | Ultra-Stable Laser Clock, Second Generation - R.L. Facklam   |
| 7-35-657 | Long Term Performance of VLG-11 Masers - J.D. White and K. McDonald  | 7-37-27  | Microprocessor for the NR Series of Hydrogen Maser Frequency Standards - E.E. Mengel and D.W. Stover   |
| 7-35-662 | Feasibility of Extremely Small Hydrogen Masers - H.E. Peters   | 7-37-32  | Mercury-199 Trapped Ion Frequency Standard: Recent Theoretical Progress and Experimental Results - L.S. Cutler, R.P. Giffard and M.D. McGuire                  |
| 7-36-223 | A Squarewave F. M. Servo System with Digital Signal Processing for Cesium Frequency Standards - Y. Nakadan and Y. Koga   | 7-37-37  | Laser Cooled Be Accurate Clock - J.J. Bollinger, W.M. Itano and D.J. Wineland  |
| 7-36-230 | Performance Characteristics of Cesium Beam Tube Electron Multipliers - E.R. Straka   | 7-37-42  | Performance of Compact Hydrogen Masers - A. Kirk   |
| 7-36-236 | A Cesium Beam Frequency Standard with Microprocessor Control - R.M. Garvey   | 7-37-49  | Cold Hydrogen Maser Research at SAO and Related Developments - R.F.C. Vessot, E.M. Mattison and E. Imbier  |
| 7-36-240 | Experimental Results of the Light-Weight Hydrogen Maser Development Program - H.E. Peters  | 7-38-387 | Lifetime and Reliability of Rubidium Discharge Lamps for Use in Atomic Frequency Standards - C.H. Volk, R.P. Frueholz, T.C. English, T.J. Lynch and W.J. Riley |
| 7-36-249 | Characteristics of Oscillating Compact Hydrogen Masers - H.T.M. Wang   |          |  |

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| 7-38-401 | Analysis of Dicke Narrowing in Wall Coated and Buffer Gas Filled Cells with Application to Gas Cell Atomic Clocks - R.P. Frueholz and C.H. Volk                       | 7-39-13  | A Recirculating Oven for Atomic Beam Frequency Standards - R.E. Drullinger, D.J. Glaze and D.B. Sullivan   |
| 7-38-408 | Evaluation of the Performance of Passive Rubidium Frequency Standards Using Cavity Operated in Mode TE, TE and TE - P. Tremblay, N. Cyr and M. Tetu                   | 7-39-18  | Optically Pumped Small Cesium Beam Standards: A Status Report - A. Derbyshire, R.E. Drullinger, M. Feldman, D.J. Glaze, D. Hilliard, D.A. Howe, L.L. Lewis, J.H. Shirley, I. Pascaru and D. Stanciulescu |
| 7-38-416 | A New Miniaturized Passive Hydrogen Maser - F.L. Walls and K.B. Persson   | 7-39-22  | Fluorescent Light Shift in Optically Pumped Cesium Standards - J.H. Shirley  |
| 7-38-420 | Design and Performance of New Hydrogen Masers Using Cavity Frequency Switching Servos - H.E. Peters   | 7-39-24  | Cesium Beam Frequency Standard for the PLSS Program - D. Silvermetz, I. Pascaru and M.P. Meirs   |
| 7-38-428 | Design and Performance of a Hydrogen Maser with a New State Selector - S. Urabe, Y. Ohta, T. Morikawa and Y. Saburi   | 7-39-29  | A Rubidium Clock Model - R.P. Frueholz and J.C. Camparo  |
| 7-38-431 | Experimental determination of the Energy of Stored Ions from the Side-Bands in their Microwave Spectrum - M. Jardino, F. Plumelle, M. Desaintfuscien and J.L. Duchene | 7-39-43  | A Highly Stabilized Semiconductor Laser and its Application to Optically Pumped Rb Atomic Clock - M. Ohtsu, M. Hashimoto and H. Ozawa  |
| 7-38-447 | Accuracy Evaluation of the RRL Primary Cesium Beam Frequency Standard - K. Nakagiri, M. Shibuki, S. Urabe, M. Ishisu, Y. Ohta, T. Morikawa and Y. Saburi              | 7-39-54  | An Ultra-Miniature Rubidium Frequency Standard - K. Chiba and T. Hashi   |
| 7-38-452 | Results on a Laser Diode Optically Pumped Cesium Beam - P. Cerez, G. Avila, M. de Labachellerie, M. Tetu and E. de Clercq   | 7-39-59  | Evaluation of the Rubidium Atomic Frequency Standard Developed in India - G.M. Saxena, A. Chatterjee, D.S. Sachdeva and B.S. Mathur  |
| 7-38-458 | Cesium Blinks Deployed in the Global Positioning System: Design and Performance Data - H. Hellwig and M.W. Levine   | 7-39-64  | Experimental Results on a Frequency Standard Based on a Rubidium 87 Maser - M. Tetu, R. Brousseau, N. Cyr, A. Michaud, P. Tremblay and B. Villeneuve   |
| 7-38-464 | Modification of an O-1695A/U Cesium Beam Frequency Standard for Retrofit of Replacement Cesium Beam Tubes - J.C. Robb   | 7-39-72  | Measurement and Interpretation of Hydrogen Maser Quality Parameters - E.M. Mattison, R.F.C. Vessot and W. Shen   |
| 7-38-471 | O-1695A/U Retrofit or Replace? - M.P. Meirs, I. Pascaru, D. Silvermetz and D. Jones   | 7-39-75  | Properties of Low-Expansion Materials For Hydrogen Maser Cavities - E.M. Mattison, R.F.C. Vessot and S.F. Jacobs   |
| 7-38-476 | A Brief Introduction to the Atomic Time and Frequency Standards at Shanghai Observatory - Z. Zao-Cheng, Z. Qi-Ziang, H. Hang-Xiang, K. Wen-Wei and D. Xiu-Feng        | 7-39-80  | Design for a Subcompact Q-Enhanced Active Maser - R.R. Hayes and H.T.M. Wang   |
| 7-39-3   | A Beam Reversal Experiment on NBS-6 Primary Cs Standard Including Rabi Pulling Evaluation - A. DeMarchi, G. Ferraris, G.D. Rovera, R.E. Drullinger and D.A. Howe      | 7-39-85  | Doppler-Free Two-Photon Laser Spectroscopy of HgII - J.C. Bergquist, D.J. Wineland, W.M. Itano, H. Hemmati, H.U. Daniel and G. Leuchs  |
| 7-39-8   | Experimental Studies on Majoorana Transitions in a Cs Atomic Beam Frequency Standard - A. Bauch and T. Heindorff  | 7-39-88  | Performance of Laser-Induced Resonance Raman Clock - P.R. Hemmer, G.P. Ontai, A. Rosenberg and S. Ezekiel  |
|          |   | 7-40-410 | Active H-Masers for V.L.B.I. Applications - R. Barillet, P. Petit, J. Viennet and C. Audoin  |

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| 7-40-413 | A Hydrogen Maser at Temperatures Below 1K - R.F.C. Vessot, E.M. Mattison, R.L. Walsworth, Jr., I.F. Silvera, H.P. Godfried and C.C. Agosta   | 7-41-53  | New Insights into Causes and Cures of Frequency Instabilities (Drift and Long Term Noise) in Cesium Beam Frequency Standards - A. DeMarchi                     |
| 7-40-419 | A Microwave Pumped Cryogenic Hydrogen Maser - W.N. Hardy, M.D. Hurlimann, R.W. Cline and A.J. Berlinsky                                      | 7-41-59  | An Optically Pumped Cesium Beam Frequency Standard for Military Applications - T. McClelland, I. Pascaru, J. Zacharski, N.H. Tran and M.P. Meirs               |
| 7-40-422 | Single-State Selection System for Hydrogen Masers - E.M. Mattison, R.F.C. Vessot and S. Wei  | 7-41-66  | Development of a Rubidium Frequency Standard for the MILSTAR Satellite System - T. McClelland, I. Pascaru and M.P. Meirs                                       |
| 7-40-428 | Progress Toward an Optically Pumped Cesium Beam Frequency Standard - R.E. Drullinger, J.H. Shirley, D.J. Glaze, L.W. Holberg and A. DeMarchi | 7-41-75  | Hydrogen Masers for Radio Astronomy - H.E. Peters, B. Owings, T. Oakley and L. Beno  |
| 7-40-432 | Effect of the Atom Transit Time on the Frequency Stability of Cesium Beam Frequency Standards - C. Audoin, V. Candelier and J. Vanier        | 7-41-82  | The New Generation of Hydrogen Maser at Shanghai Observatory - Z.C. Zhai, H.X. Huang, G.X. Jiang, W.H. Luo, J.F. Lu and C.F. Lin                               |
| 7-40-432 | Effect of the Atom Transit Time on the Frequency Stability of Cesium Beam Frequency Standards - C. Audoin, V. Candelier and J. Vanier        | 7-41-87  | Performance of a Hydrogen Maser with Auto-Tuning Utilizing Cavity Q Modulation - T.K. Tucker and G.J. Dick   |
| 7-40-441 | A Novel Cavity Design for Minimization of Distributed Phase Shift in Atomic Beam Frequency Standards - A. DeMarchi                           | 7-41-91  | Hyperfine Contribution to Spin-Exchange Frequency Shifts in the Hydrogen Maser - B.J. Verhaar, J.M.V.A. Koelman, H.T.C. Stoof, O.J. Luiten and S.B. Crampton   |
| 7-40-447 | A Comparison of Various Alkali Gas Cell Atomic Frequency Standards - J.C. Camparo and R.P. Frueholz  | 7-41-95  | Surface Interaction of Atomic Hydrogen with Teflon - E.M. Mattison, R.F.C. Vessot, C. Bain, S. Wasserman and G. Whitesides                                     |
| 7-40-465 | A Disciplined Rubidium Oscillator - A. MacIntyre and S.R. Stein  | 7-42-490 | Performance of the PTB's Primary Clocks CS2 and CS1 - A. Bauch, H. DeBoer, B. Fischer, T. Heindorff and R. Schroeder   |
| 7-40-470 | Subminiature Rubidium Oscillator Model FRS - W. Weidemann  | 7-42-496 | Research on the Optically Pumped Cesium Beam Frequency Standards - G. Theobald, V. Giordano, M. de Labachellerie, A. Hamel, N. Dimarcq, P. Cerez and C. Audoin |
| 7-41-12  | Initial Operational Experience with a Mercury Ion Storage Frequency Standard - L.S. Cutler, R.P. Giffard, P.J. Wheeler and G.M.R. Winkler    | 7-42-505 | Calculations on the Efficiency of Optical Pumping of a Cesium Atomic Beam by Lasers of Finite Linewidth - C. Jacques and P. Tremblay                           |
| 7-41-20  | JPL Trapped Ion Frequency Standard Development - J.D. Prestage, G.J. Dick and L. Maleki  | 7-42-510 | Cesium Gettering by Graphite and Colloidal Graphite (Aquadag) - N.D. Bhaskar and C.M. Kahla  |
| 7-41-25  | Ultra-Sensitive Frequency Discrimination in a Diode Laser Pumped 87 Rb Atomic Clock - M. Hashimoto, H. Furuta and M. Ohtsu                   | 7-42-514 | The Effect of Humidity on Commercial Cesium Beam Atomic Clocks - J.E. Gray, H.E. Machlan and D.W. Allan  |
| 7-41-36  | A Three Dimensional Model of the Gas Cell Atomic Frequency Standard - J.C. Camparo and R.P. Frueholz   | 7-42-519 | A Novel Compact Rubidium Frequency Standard with a Low Sensitivity to Magnetic and Vibrational Disturbances - A. Stern, A. Hertz, Y. Zarfaty and A. Lepek      |
| 7-41-47  | Cesium Gettering by Graphite - N.D. Bhaskar, C.M. Kahla, R.P. Frueholz and R.A. Cook   |          |  |



CATEGORY 7 (Cont'd):

- 7-42-525 An Improved Rubidium Consumption  
Model for Discharge Lamps Used in  
Rubidium Frequency Standards - R.A.  
Cook and R.P. Frueholz
- 7-42-532 Neutron Hardness of Photodiodes for  
Use in Passive Rubidium Frequency  
Standards - T.C. English, G. Malley  
and R. Korde

# CATEGORY 8:

## Quantum Electronic Frequency Standards (Visible and Infrared Frequencies)

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|----------|--|----------|---|
| 8-15-225 | The Optical Maser - W. Kaiser  | 8-29-328 | High Speed Rectifying Junctions in the Infrared Regions: Recent MIT Developments - A. Sanchez   |
| 8-17-425 | Frequency Standards in the Optical - Range - G. Gould  | 8-29-330 | Frequency Stabilization of CO <sub>2</sub> Lasers - C. Freed  |
| 8-21-455 | Techniques for Generating, Detecting and Phase Stabilizing Submillimeter Coherent Radiation - G.W. Bechtold, V.E. Derr and W.T. Smith                                      | 8-29-338 | Potential Frequency Accuracy of the CO <sub>2</sub> Fluorescence Saturation Dip - M.J. Kelly, J.E. Thomas, J.P. Monchalin, N.A. Kurnit and A. Javan             |
| 8-23-305 | Frequency Mixing and Multiplication in the Far Infrared and Infrared - A. Javan  | 8-29-344 | Limitations on Miniature Molecular Frequency Sources - J.J. Gallagher   |
| 8-23-306 | Pressure Shift and Broadening of Methane Line at 3.39 Micron Studied by Laser-Saturated Molecular Absorption - R.L. Barger and J.L. Hall                                   | 8-31-574 | Detecting and Mixing at FIR/Submillimeter Wavelengths With Submicron Size Schottky Barrier Diodes - M. McColl, D.T. Hodges, A.B. Chase and W.A. Garber          |
| 8-23-307 | Stability Investigations of HCN Laser - V.J. Corcoran, R.E. Cupp and J.J. Gallagher  | 8-31-578 | A Narrow Output Linewidth Multiplier Chain for Precision Frequency Measurement in the 1 THz Region - E. Bava, A. DeMarchi and A. Godone                         |
| 8-23-312 | Laser Frequency Stabilization Using a Primary Frequency Reference - S. Ezekiel   | 8-31-583 | A Study of Point-Contact Josephson Junctions for use in Frequency Synthesis - A.S. Risley   |
| 8-24-233 | Laser Frequency Stabilization Techniques and Its Applications - H.S. Boyne   | 8-31-590 | Optical Electronics, Extension of Microwave Techniques Into the Optical Region - C.F. Davis, Jr., G. Elchinger, A. Sanchez, K.C. Liu and A. Javan               |
| 8-24-240 | Automatic Frequency Control and Phaselocking of Lasers - V.J. Corcoran, R.E. Cupp and J.J. Gallagher   | 8-31-592 | Progress in CO <sub>2</sub> Laser Stabilization - C. Freed  |
| 8-24-275 | Frequency Stabilization of CO <sub>2</sub> Lasers with Respect to Passive SF <sub>6</sub> and CO <sub>2</sub> Line Centers - P. Rabinowitz, R. Keller and J.T. LaTourrette | 8-31-601 | Electronic Tuning and Phase-Lock Techniques for Optically Pumped Far Infrared Lasers - S.R. Stein and H. Van de Stadt   |
| 8-26-250 | A Stabilized HCN Laser for Infrared Frequency Synthesis - J.S. Wells   | 8-31-605 | Frequency Modulation of a Far Infrared CH <sub>3</sub> F Laser by Stark Effect - R. Benedetti, A. Di Lieto, M. Inguscio, P. Minguzzi, M. Tonelli and F. Strumia |
| 8-27-376 | Characteristics of the 644 nm He-Ne Laser Stabilized by Saturated Absorption in Iodine Vapour - A.J. Wallard   | 8-31-612 | The Trapped Mercury Ion Frequency Standard - M.D. McGuire   |
| 8-27-382 | Molecular Beam Stabilized Laser - L.A. Hackel, D.C. Youmans and S. Ezekiel   | 8-32-439 | Saturated Absorption Optical Ramsey Fringes - J.C. Bergquist, R.L. Barger and D.J. Glaze  |
| 8-27-386 | Influence of Hyperfine Structure of Methane Stabilized He-Ne Laser - C. Borde and J.L. Hall  | 8-33-494 | Laser to Microwave Frequency Division Using Synchrotron Radiation II - J.C. Bergquist and D.J. Wineland   |
| 8-28-348 | Infrared Rectification and Frequency Mixing in a Thin Film Metal, Metaloxide, Metal Diode Structure - A. Javan and J.G. Small  | 8-33-498 | An Improved Multiplier Chain For Precise Frequency Measurements Up to 20 THz - A. Godone, A. DeMarchi and E. Bava   |
| 8-29-316 | Frequency Stabilization of a CW Dye Laser and Laser Saturation of Atomic Beams - R.L. Barger, T.C. English and J.B. West   |          |   |

CATEGORY 8 (Cont'd):

- 8-33-504 Comparison of Different Tuning and Modulation Techniques for F. I. R. Lasers - A. DeMarchi, A. Godone and E. Bava
- 8-35-596 Mono-Ion Oscillator as Potential Ultimate Laser Frequency Standard - H. Dehmelt
- 8-36-327 Frequency Stabilization of AlGaAs Lasers - M. Ohtsu, H. Tsuchida and T. Tako
- 8-36-338 Frequency Stability and Control Characteristics of (GaAl)As Semiconductor Lasers - A. Mooradian and D. Welford
- 8-36-355 Spectral Characteristics of Single Mode GaAlAs Semiconductor Lasers - R.O. Miles
- 8-36-361 Ultra-Stable Laser Clock - R.L. Facklam
- 8-36-370 A Laser Atomic Beam Standard - C.C. Leiby, Jr., R.H. Picard, J.E. Thomas, P.R. Hemmer and S. Ezekiel
- 8-41-42 Study of Several Error Sources in a Laser Raman Clock - P.R. Hemmer, B. Bernacki, V.D. Natoli, M.S. Shahriar, H. Lamela-Rivera, S.P. Smith and S. Ezekiel

# CATEGORY 9:

## Frequency and Time Coordination and Distribution

9-10-216	Comparison Measurements on Frequency Standards - J.A. Pierce	9-20-577	A Digital Servo for Frequency and Time Scale Conversion - P. Kartaschoff and H. Brandenberger
9-11-574	Low Frequency Standard Transmissions - W.D. George	9-20-588	Time Synchronization of Remote Clocks Using Dual VLF Transmissions - A.R. Chi and S.N. Witt, Jr.
9-12-648	Comparison of Atomichrons with British Cesium Beam Frequency Standard - A.O. McCoubrey, J.H. Holloway, W. Mainberger, F.H. Reder, G.M.R. Winkler, L. Essen and J.V.L. Parry	9-20-612	VLF Envelope Timing Experiment - D. Himes
9-12-665	Comparison of Atomic and Astronomical Time - W.M. Markowitz	9-20-613	Use of Loran-C for Timing and Frequency Comparison - L.D. Shapiro
9-13-316	The System of Atomic Time, A.1 - W.M. Markowitz	9-21-509	Frequency Comparison System for Spacecraft Relativity Experiment - D. Kleppner
9-13-318	Atomic Frequency Standards for Propagation Studies - J.A. Pierce	9-22-383	Recent Improvements in the U. S. Naval Observatory Timekeeping and Time Distribution Operations - G.M.R. Winkler
9-13-342	Synchronized Clock Experiment - R. Bridgham, F.H. Reder and G.M.R. Winkler	9-22-384	Clock Error Statistics as a Renewal Process - G.E. Hudson and J.A. Barnes
9-14-254	Preliminary Results on Project WOSAC - G.M.R. Winkler and F.H. Reder	9-22-419	Results of Differential Omega Test and Evaluation Program - J.R. Wright
9-14-267	Results of GBR Experiment - J.A. Pierce	9-22-441	Precise Frequency Comparison Using a Frequency Tracking Technique - W.V. Burhop and L.G. Wilson
9-14-275	Stabilization of VLF Transmissions at NBA - H.F. Hastings and W.M. Markowitz	9-23-18	International Coordination of Radio Time Signal Emission - H. Smith
9-14-276	Timing Potential of Loran-C - G. Hefley, R.F. Linfield and R.H. Doherty	9-23-236	Use of the Loran-C System for Time and Frequency Dissemination - P.E. Pakos
9-15-226	Final Results of a World-Wide Clock Synchronization Experiment (Project WOSAC) - F.H. Reder, P. Brown, G.M.R. Winkler and C.J. Bickart	9-23-248	An Application of Statistical Smoothing Techniques on VLF Signals for Comparison of Time Between USNO and NBS - A. Guetrot, D.W. Allan, L.S. Higbie and J. Lavanceau
9-16-227	Synchronization of Local Frequency Standards with VLF Transmissions - R.R. Stone, Jr.	9-23-249	A Coordinate Frequency and Time System - G.E. Hudson, D.W. Allan, J.A. Barnes, J. Lavanceau, R.G. Hall and G.M.R. Winkler
9-16-249	Time Keeping Satellites - R.H. Dicke	9-24-315	Time/Frequency Technology in System Development - R.E. Perkinson
9-16-250	Theory of Time Keeping in Space - R.K. Sachs	9-24-322	A Survey of Time and Frequency Dissemination Techniques - J.L. Jespersen
9-18-251	High Precision Frequency and Clock Synchronization Techniques on an International Basis - W.M. Markowitz	9-24-325	Time and Frequency Transfer Via Microwave Link - D.E. Phillips, R.E. Phillips and J.J. O'Neill
9-18-395	VLF Frequency Synchronization Provided with FSK Capability - R.R. Stone, Jr. and T.H. Gee	9-24-332	Diurnal Phase of VLF Signals Near Antipode of a Transmitter - A.R. Chi
9-19-195	A Report on the Hewlett-Packard Flying Clock Experiment Number Two - L.N. Bodily	9-24-339	A Second Satellite Oscillator Experiment - R. Easton, C. Bartholomew and J.A. Bowman
9-19-297	Clock Synchronization Via Relay II, Preliminary Report - W.M. Markowitz and C.A. Lidback		

# CATEGORY 9 (Cont'd):

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| 9-24-345 | The Omega Navigation System as a Source of Frequency and Time - W. Palmer  | 9-27-286 | Diurnal and Seasonal Variations in Atmospheric Time Delay - D.M. LeVine   |
| 9-25-152 | Time Control of Frequency Shift Keyed Transmissions at VLF - R.R. Stone, Jr., T.H. Gattis and T.N. Lieberman   | 9-27-290 | Application of Phase Stable VLF Signals in Small Aircraft - J.J. Tymczysyn  |
| 9-25-159 | Omega VLF Timing - E.R. Swanson  | 9-27-296 | Active and Passive Relative Synchronization of Remote Clocks in a Time Ordered System - P. Coralnick and R.C. Stow  |
| 9-25-167 | Time Dissemination Capabilities Using the Omega System - L. Fey  | 9-27-304 | Accuracy of Overland Radio Location System at Fort Hood Using 1.5 to 2.0 MHz Frequency Region - J.R. Wright   |
| 9-25-171 | Use of Loran-C Over Land - B. Wieder   | 9-27-312 | UHF Frequency Translator Based on Regenerative Division - J.J. O'Neill, D.E. Phillips and R.R. Stone, Jr.   |
| 9-25-179 | One Way Time Dissemination from Low Altitude Satellites - L. Reuger  | 9-28-373 | Reference Frequency Transmission over Bell System Radio and Coaxial Facilities - R.F. Powers  |
| 9-25-186 | Time Transfer by Defense Communications Satellite - J.A. Murray, D.L. Pritt, L.W. Blocker, W.E. Leavit, P.M. Hooton and W.D. Goring                                    | 9-28-379 | A Comparison of the Cesium and Hydrogen Hyperfine Frequencies by Means of Loran C and Portable Clocks - V.S. Reinhardt and J. Lavanceau   |
| 9-25-194 | Long Term Accuracy of Time Comparisons Via TV Radio Relay Links - S. Leschiutta  | 9-28-384 | Satellite to Ground Timing Experiments - R.J. Taylor  |
| 9-25-195 | Precision and Accuracy of Remote Synchronization Via Portable Clocks, Loran-C, and Network Television Broadcasts - D.W. Allan, D.D. Davis, B.E. Blair and H.E. Machlan | 9-28-389 | Collecting and Processing PTTI Data - L.C. Fisher   |
| 9-25-209 | Methods of Local Time and Frequency Transfer - D.H. Phillips, R.E. Phillips, J.A. Bowman and J.J. O'Neill  | 9-28-395 | Frequency Synthesizer for Normalizing the Frequency and Time Scales of Crystal Clocks on Orbiting Satellites - L.J. Rueger and A.G. Bates   |
| 9-25-217 | International Coordinated Clock Time and the Coming Improvements in System "UTC" - G.M.R. Winkler  | 9-28-406 | Digital Clock Synchronization via Switched Long Distance Telephone Lines - C.C. Costain, L.G. Miller and A. Nishimura   |
| 9-26-269 | The Standards of Time and Frequency in the U. S. A. - J.A. Barnes and G.M.R. Winkler   | 9-28-408 | Performance Data of Space and Ground Hydrogen-Masers and Ionospheric Studies for High Accuracy Frequency Comparison Between Space and Ground Clocks - R.F.C. Vessot and M.W. Levine |
| 9-26-292 | Nationwide Precise Time and Frequency Distribution Utilizing an Active Code Within Network Television Broadcasts - D.A. Howe   | 9-29-384 | Sub-Microsecond Time Transport with a Rubidium Portable Clock - H. Hellwig and A.E. Wainwright  |
| 9-26-309 | Time Transfer Using Nearly Simultaneous Reception Times from a Common Transmitter - D.W. Allan, H.E. Machlan and J. Marshall   | 9-30-401 | Minimum Variance Numerical Methods for Synchronizing Airborne Clocks - R.J. Kulpinski   |
| 9-26-317 | Standard Frequency and Time Service Using Radio Broadcasting Facilities - L.H. Montgomery  | 9-30-438 | Phase Synchronization of a large HF Array by a Local Broadcast Station - S.H. Taheri, B.D. Steinburg and D.L. Carlson   |
| 9-27-270 | Time Synchronization of NASA Tracking Stations via LORAN-C - W.E. Mazur  | 9-30-444 | The Remote Synchronization Technology - L.J. Rueger   |
| 9-27-277 | International Time Transfer Using the Timation II Satellite - J.A. Buisson   |          |   |

# CATEGORY 9 (Cont'd):

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| 9-31-429 | Synchronization Methods for Frequency - And Time-Division-Multiplex Networks - H.L. Hartman  | 9-34-334 | Accurate Time and Frequency Transfer During Common-View of a GPS Satellite - D.W. Allan and M.A. Weiss  |
| 9-31-436 | Frequency Control and Digital Network Synchronization - M.I. Spellman, J.B. Cain and D.B. Bradley  | 9-35-532 | NAVSTAR Global Positioning System (GPS) Clock Program: Present and Future - D.M. Tennant  |
| 9-31-448 | Frequency Coordination in a Network of Integrated Switches - H.A. Sunkenberg and M.J. Ross   | 9-35-537 | Time Dissemination Using NAVSTAR Global Positioning System (GPS) Phase IIB User Equipment - M.D. Yakos and E.H. Hirt  |
| 9-31-455 | Results of Investigations for the Clock Frequency Control and Distribution System in the Digital Telephone and Data Networks of the Deutsche Bundespost and Future Plans - W.R. Slabon   | 9-35-546 | Construction and Performance Characteristics of a Prototype NBS/GPS Receiver - D.D. Davis, M.A. Weiss, A. Clements and D.W. Allan                                   |
| 9-31-463 | Synchronization of a Digital Network Using a Position Lock and HMS System - P.K. Verma, C. Lemieux and H. Daams  | 9-35-553 | The NATO III 5 MHz Distribution System - A.I. Vulcan and M.B. Bloch   |
| 9-31-465 | An Overview of TDMA for Digital Satellite Communications and the Censar Synchronization Experiment - K.E. Brown and P.P. Nuspl   | 9-35-565 | Low Noise Buffer Amplifiers and Buffered Phase Comparators for Precise Time and Frequency Measurement and Distribution - R.A. Eichinger                             |
| 9-31-489 | Time Determination for Spacecraft Users of the Navstar Global Positioning System (GPD) - T.J. Grenchik and B.T. Fang   | 9-36-372 | The U.S. Navy's Standardized Precise Time and Time Interval (PTTI) Platform Distribution System (PDS) - R.T. Allen  |
| 9-31-495 | Transcontinental and Intercontinental Portable Clock Time Comparison - H. Hellwig, D.W. Allan, S.R. Stein and K.A. Prichard  | 9-36-378 | Optimal Time and Frequency Transfer Using GPS Signals - D.W. Allan and J.A. Barnes  |
| 9-31-499 | Distant Comparison of Stable Frequency Standards by Means of the Transmission of a Beat Note Between the Carrier of a TV Broadcast Signal and a Frequency Synthesized from the Frequency Standards - A. Gabry, G. Faucheron, B. Dubouis and P. Petit | 9-36-388 | Test Results of the STI GPS Time Transfer Receiver - D.L. Hall and K. Putkovich   |
| 9-31-503 | Study of L. F. and V. L. F. Time Signals by Digital Method - F. Guillaume, J.C. Lieven and J. DePrins  | 9-37-55  | National and International Time and Frequency Comparisons - D.W. Allan  |
| 9-33-468 | A New Approach to Data Management and Its Impact on Frequency Control Requirements - D.L. Blanchard, A.J. Fuchs and A.R. Chi   | 9-37-61  | An International Time Transfer Experiment - C. Wardrip, J.A. Buisson, O. Oaks, M. Lister, S. Stebbins, B. Guinot, M. Granveaud, G. Freon, B. Dubois and W. Schluter |
| 9-33-473 | Two-Way Time Transfers Between National Research Council (Ottawa) and Paris Observatory Via the "Symphonie" Satellite - C.C. Costain, J.S. Boulanger, H. Daams, L.G. Miller, G. Freon, P. Parcelier, M. Brunet, J. Azoubib and B. Guinot             | 9-37-67  | Precision Timekeeping at the Observatory Lustuehel, Graz, Austria - D. Kirchner   |
| 9-34-326 | Initial Test Results of USNO GPS Time Transfer Unit - K. Putkovich   | 9-37-78  | Time Dissemination from the National Research Council of Canada - C.C. Costain, H. Daams, J.S. Boulanger and R.J. Douglas   |
|          |  | 9-39-107 | Time Scale Stabilities Based on Time and Frequency Kalman Filters - J.A. Barnes and D.W. Allan  |
|          |  | 9-39-145 | Development of a GPS Time-Transfer Receiver and Time Comparison Results - M. Imae, M. Uratsuka, C. Miki, T. Morikawa, K. Akatsuka and K. Yoshimura                  |

CATEGORY 9 (Cont'd):

- 9-39-150 Commercial GPS Receiver for Time and Frequency Equipment Applications - R.L. Lewis, G.F. Knoernschild and N.B. Hemesath
- 9-39-153 The State-of-the-Art Medium Terminal (SAMT) Time and Frequency Distribution System - A.I. Vulcan and M.B. Bloch
- 9-39-183 Recent Developments in Synchronization and Tracking with Synchronous Oscillators - T. Flamouropoulos, M.H. White and V. Uzunoglu
- 9-40-394 Using Multiple Reference Stations to Separate the Variances of Noise Components in the Global Positioning System - M.A. Weiss and D.W. Allan
- 9-40-405 The U.S. Naval Observatory (USNO) PTTI Data Service - G.M.R. Winkler
- 9-41-111 Accuracy of Time Transfer in Satellite Systems - C.M. Will
- 9-41-130 Positioning and Timing Study of GPS C/A Code Receivers - Q. Zhuang, W.J. Klepczynski and C.F. Lukac
- 9-41-144 Estimating Combined Errors Due to Propagation and Ephemeris and Their Effect on Time and Frequency Transfer - D.W. Allan and L. Ping-Ping
- 9-41-149 Ku-Band Satellite Two-Way Timing Using a Very Small Aperture Terminal (VSAT) - D.A. Howe
- 9-41-161 Reference Frequency Distribution Over Optical Fibers: A Progress Report - G. Lutes
- 9-42-465 Ensemble Time and Frequency Stability of GPS Satellite Clocks - D.W. Allan and T. Peppler
- 9-42-472 Preliminary Comparison Between GPS and Two-Way Satellite Time Transfer - W.J. Klepczynski, P.J. Wheeler, W. Powell, J. Jeffries, A. Myers, R.L. Clarke, W.P. Hanson, J.L. Jespersen and D.A. Howe
- 9-42-478 Fiber Optic Frequency Transfer Link - L. Primas, G. Lutes and R.L. Sydnor
- 9-42-485 Israel's New Synchronized Time Scale, UTC (INPL) - A. Shenhar, W. Litman, A. Lepek, A. Citrinovitch, D.W. Allan and T. Peppler

## CATEGORY 10:

### Applications of Frequency Control Devices

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| 10-10-439 Crystal Requirements for Future Military Equipment - J.M. Havel   | 10-25-104 The Present State of the Art in Piezoelectric Sensors - W. King   |
| 10-12-193 A Frequency Standard for Use in Missiles - H.P. Brower  | 10-25-125 Quartz Crystal Units for High G Environment - M. Bernstein  |
| 10-13-248 A Communications Requirement of the Space Age - W.K. Victor   | 10-26-4 Precise Time and Frequency in a Communication System - H. Folts   |
| 10-13-261 Frequency Control Devices and the Micro Module Program - M. Bernstein   | 10-26-8 Synchronization in High Capacity Broadband Carrier Systems - J.F. Barry and S. Narayanan                                  |
| 10-14-404 Frequency Standards for Military Applications - D.E. Johnson and J.P. Fredericks  | 10-26-15 Frequency Control Aspects in Army Communications and Surveillance - E. Hafner  |
| 10-21-512 The Design of an Atomic Hydrogen Maser System for Satellite Experiments - R.F.C. Vessot, M.W. Levine, L.F. Mueller and M. Baker | 10-26-21 Short Term Frequency Stability in Coherent Radar Applications - W.K. Saunders  |
| 10-22-206 The Application of Piezoelectric Coupled-Resonator Devices to Communication Systems - W.L. Smith                                | 10-26-113 Frequency Control Requirements for Remote Sensor Systems - W.D. Lawrence  |
| 10-22-342 Crystal Oscillator Satellite Experiment - R. Easton, A. Bartholomew, D.E. Phillips and M.B. Bloch                               | 10-27-39 Quartz Crystal Units for Space Applications - C. Gilbert, S. Broussou and J. Morel                                       |
| 10-23-1 Frequency Control Requirements for the Mallard Communication System - J. DelVecchio and J. Dressner                               | 10-29-417 Time Standard Error Modeling with Applications to Satellite Navigation - G.L. Mealy and D.R. Vander Stoep               |
| 10-23-8 Application of Precise Time-Frequency Technology in Multi-Function Systems - T.C. Viars   | 10-30-371 Frequency Control and Time Information in the NAVSTAR/Global Positioning System - F.E. Butterfield                      |
| 10-23-14 Frequency Control for Tactical Net SSB Equipment - O.P. Layden   | 10-30-375 Time Requirements in the NAVSTAR Global Positioning System (GPS) Control Segment - A.J. Van Dierendonck and M. Birnbaum |
| 10-23-157 A Flexure-Mode Quartz for an Electronic Wrist Watch - M.P. Forrer   | 10-30-384 Oscillator and Frequency Management Requirements for GPS User Equipments - R.A. Maher                                   |
| 10-25-70 Quartz Crystal Applications in Digital Transmission - R.B. Robrock II  | 10-30-390 NAVSTAR Global Positioning System - Oscillator Requirements for the GPS Manpack - J. Moses                              |
| 10-25-74 Frequency Control Devices for Mobile Communications - R.J. Nunamaker   | 10-31-71 Using the X-Y Flexure Watch Crystal as a Pressure-Force Transducer - A. Genis and D.E. Newell                            |
| 10-25-75 The Crystal Controlled Electronic Wrist Watch System: A Si-gate and CMOS-MSI Approach - R.G. Daniels and F.H. Musa               | 10-31-478 Frequency Control and Timing Requirements for Communications Systems - P. Kartaschoff                                   |
| 10-25-82 Frequency and Time in Airtraffic Control and Collision Avoidance Application - V.I. Weihe  | 10-31-484 Generation of Base-Band Frequencies for FDM and TDM Telecommunications - E.P. Graf and B. Walther                       |
| 10-25-88 Application of Crystal Clocks for Navigation and Time-Ordered Communication - R.J. Kulpinski                                     | 10-32-555 Applications of Atomic Frequency Standards to Satcom Spread Spectrum Systems - S.A. Nichols and D.G. Woodring           |
| 10-25-94 Time Synchronized Ranging System - R.M. Aughey   | 10-34-347 Time Related Aspects of the Position Location Reporting System - J.E. Liroy   |
| 10-25-102 Piezoelectric Sensors for Use as Pollution Detectors, Meteorology Monitors and Research Instruments - J. Kertzman               |   |



CATEGORY 10 (Cont'd):

- 10-35-501 Frequency Control Requirements for  
800 MHz Land Mobile Communication -  
R.G. Kinsman and D. Gunn
- 10-35-511 Frequency Stabilization Requirements  
for Modern Millimeter Wave Systems -  
A. Tirkel
- 10-35-516 Frequency Stability Requirements for  
a 95 GHz Instrumentation Radar  
System - D.N. McQuiddy, Jr.
- 10-35-525 Optical Frequency Control for  
Wavelength Multiplexed Systems - F.  
Welsh and T. Stakelon
- 10-38-92 Vibration Effects on EHF System  
Performance Employing Low Noise  
Rubidium Standard and Crystal  
Filters - E.M. Perdue
- 10-42-453 Radar Measurement Applications of  
Fiber Optic Links - I. Newberg, C.  
Gee, G. Thurmond and H.W. Yen

## CATEGORY 11:

### Measurements and Specifications

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| 11-10-305 VHF Crystal Measurements - G.K. Guttwein and D. Pochmerski   | 11-16-187 The Measurement of the Parameters of High Frequency Filter Crystals - F.K. Priebe  |
| 11-10-323 A New Method for Measuring the Equivalent Parameters of VHF Quartz Crystals - D.W. Robertson                                 | 11-17-289 Reliability of Military Quartz Crystal Units - W. Ingling and C.E. Jones   |
| 11-10-496 A Counter Transfer Oscillator System for Microwave Frequency Measurements - A.S. Bagley and D. Hartke                        | 11-17-312 Spurious Modes in AT-Cut Quartz Crystals - A.E. Anderson   |
| 11-11-402 Frequency Control Standardization Trends Within the International Electrotechnical Commission - W.J. Young                   | 11-17-314 Temperature Testing Tight Tolerance Crystal Units - G.K. Bistline, Jr.   |
| 11-11-441 Equipment for Detecting Unwanted Modes in Oscillator Crystals - J. Loos  | 11-17-316 The Hybrid-Coil Bridge Method of Measuring Unwanted Modes of Vibration in Quartz Crystals - W.H. Horton and R.C. Smythe                            |
| 11-11-457 Low Frequency C.I. Meter AN/TSM-14 - E.A. Gilbert  | 11-17-464 Progress and Problems in Quartz Crystal Circuitry and Measurements - O.P. Layden   |
| 11-11-463 VHF C.I. Meter AN/TSM-15 - D. Pochmerski   | 11-17-537 Accuracy of VHF Filter Crystal Measurements - A.D. Ballato and F.K. Priebe   |
| 11-11-479 Crystal Measuring Techniques Above 200 mc/sec - S.N. Witt, Jr.   | 11-17-602 Measurement of the Instantaneous Frequency and Phase Stability of Frequency Standards by Means of Frequency Comparators - B. Parzen                |
| 11-11-597 Precision Measurement of Short Time Intervals - F.K. Priebe, D. Schwab and H.D. Tanzman                                      | 11-18-243 Frequency and Timing Control Requirements for Future Military Communication Equipment - M.M. Baltas  |
| 11-12-334 Measuring the Resonance Frequency of Quartz Crystals with Improved Accuracy - A.O. Plait, H.G. Tobinski and H.E. Gruen       | 11-18-407 Quantity Testing of Moderate-Precision Crystal Units - G.E. Buroker  |
| 11-12-359 An Instrument for Detecting Unwanted Modes in Oscillator Crystals - J. Loos  | 11-18-441 Design Considerations for Crystal Impedance Meters - C.L. Shibla   |
| 11-12-383 VHF Crystal Parameter Measurements - S.N. Witt, Jr.  | 11-18-458 Comparison of Various Methods Used for Determination of Quartz Crystal Parameters in the Frequency Range 1 to 30 MC - F.K. Priebe and A.D. Ballato |
| 11-13-123 Measurement of HF Crystal Units with Increased Accuracy - D. Pochmerski and C.L. Shibla                                      | 11-19-49 Aerospace Crystal Environmental Requirements - D.B. Leeson  |
| 11-13-137 Methods of Measuring Quartz Crystal Units at VHF - S.N. Witt, Jr.  | 11-19-436 Comparison of Crystal Measurement Equipment - W.H. Horton and S.B. Boor  |
| 11-13-354 Measuring Instruments for Determination of Electrical Characteristics of Quartz Over the Range from 0 to 300 mc - H. Flicker | 11-19-469 Automatic Crystal Aging Assembly - M. Bernstein  |
| 11-13-384 Short-term Frequency Stability Measurements - H.D. Tanzman   | 11-19-487 Attenuation and Resistance Measurements of Unwanted Modes of Quartz Crystals - F.K. Priebe   |
| 11-15-98 Higher Precision Crystal Measurements 1 - 15 Mc - M. Bernstein  | 11-19-655 Modification of Crystal Impedance Meter TS-710/TSM - C.L. Shibla   |
| 11-15-261 The Effects of Frequency Multipliers on the Uncertainty of a Frequency Measurement - J. Rarity, L. Saporta and G. Weiss      | 11-20-465 Measurement of Mode Parameters by Sweep Frequency Methods in the Frequency Range from 20 to 250 MHz - F.K. Priebe and A.D. Ballato                 |

# CATEGORY 11 (Cont'd):

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| 11-20-636 Precision Frequency Measurement of Satellite Emitted Beacon Signals - P.R. Arendt  | 11-24-168 Precision Measurement of Crystal Frequency by Means of "Center Line Method" - I. Koga  |
| 11-20-648 Experimental Frequency-Measuring Receiver System - F.D. Lewis  | 11-24-177 Quartz Crystal Measurements - E. Hafner, A.D. Ballato and P.R. Blomster  |
| 11-20-661 Digital and Automatic Printing Frequency Counter System - U.E. Adelsberger   | 11-24-301 Frequency Comparison of Five Commercial Standards with a NASA Experimental Hydrogen Maser - A.R. Chi, F.G. Major and J.E. Lavery             |
| 11-20-672 A New Instrument for Automatic Measurement of Microwave Frequencies - R.L. Allen   | 11-25-113 Measurement of Vibration Modes of Piezoelectric Resonators by Means of Holography - Y. Tsuzuki, Y. Hirose and K. Iijima                      |
| 11-21-273 Short Term Frequency Stability Measurements - M.E. Frerking  | 11-25-118 Study of Frequency Control Devices in the Scanning Electron Microscope - R.J. Gerdes and C.E. Wagner   |
| 11-22-46 Writing Crystal Specifications - J.D. Holmbeck  | 11-25-134 Using a Pendulum Diffractometer to Improve Precision of X-Raying Quartz Crystals - G.E. Nemetz   |
| 11-22-163 Temperature Testing Quartz Crystals, Equipment and Methods - G.K. Bistline, Jr. and R. Pompeo  | 1-25-148 Standards and the Frequency Control Industry - J.D. Holmbeck  |
| 11-22-164 Reliable and Repeatable Measurements of Frequency and Resistance Changes of Quartz Crystals Due to Wide Temperature Variations - R. Schade | 11-25-222 Frequency Modulation Analysis with the Hadamard Variance - R.A. Baugh  |
| 11-22-232 Precision Measurement of the Frequency Aging of Quartz Crystal Units - M. Bernstein  | 11-25-226 High Quality Quartz Crystal Oscillators: Frequency Domain and Time Domain Stability - H. Brandenberger, F. Hadorn, D. Halford and J.H. Shoaf |
| 11-22-248 Measurement Techniques for Quartz Crystals - C.A. Adams  | 11-26-20 Problems in the Definition and Measurement of Frequency Stability - J.A. Barnes   |
| 11-22-259 Technique for Crystal Resonance Measurements Based on Phase Detection in a Transmission Type Measurement System - R.P. Grenier             | 11-26-29 Flicker and Frequency Phase, and White Frequency and Phase Fluctuations in Frequency Sources - D.J. Healey III                                |
| 11-22-282 Newly Developed Crystal Measurement Instruments - O.P. Layden, A.D. Ballato and C.L. Shidla  | 11-26-79 Calculator Controlled Testing of Crystals and Crystal Filters - G.E. Nelson   |
| 11-22-592 Long-Term Frequency Stability Measurement of Rubidium Gas Cell Frequency Standards - A.R. Chi, J.H. Roeder, S.C. Wardrip and B. Kruger     | 11-26-159 The Practical Aspects of International Standardization in the Frequency Control Field - E. Kentley   |
| 11-23-93 Vector Voltmeter Crystal Measurement System - M.E. Frerking   | 11-26-258 US Army Calibration Program - J.M. Rivamonte   |
| 11-23-102 On Precision Measurements of Frequency and Resistance of Quartz Crystal Units - C. Franx   | 11-26-260 USAF Time and Frequency Calibration Program - J.F. Barnaba   |
| 11-23-111 Another Look at Specifying Crystals - D.W. Nelson  | 11-27-55 Practical Crystal Measurements and Standardization - W.S. Metcalf   |
| 11-23-122 Temperature Run, MIL-C-3098, Amendment I - R. Pompeo and F. Wolf   | 11-27-63 An Automatic Crystal Measurement System - H.S. Pustarfi and W.L. Smith  |
| 11-23-223 A Carrier Suppression Technique for Measuring S/N and Carrier/Sideband Ratios Greater than 120 dB - C.H. Horn                              |  |

# CATEGORY 11 (Cont'd):

- 11-27-421 Spectral Density Analysis: Frequency Domain Measurements of Frequency Stability - D. Halford, J.H. Shoaf and A.S. Risley
- 11-27-432 A New Development in the Field of Spectrum Analyzers - K. Zirwick
- 11-27-440 Short and Long Term Stability Measurements Using Automatic Data Recording System - J.A. Bowman
- 11-28-49 Precision Determination of Parameters of VHF Crystals - I. Koga
- 11-28-177 Direct Measurements of the Inherent Frequency Stability of Quartz Crystal Resonators - A.E. Wainwright, F.L. Walls and W.D. McCaa
- 11-28-184 Low Noise Measuring Techniques - M.B. Bloch and A.I. Vulcan
- 11-28-190 L(f) Measurements on UHF Sources Comprising VHF Crystal Controlled Oscillator Followed by a Frequency Multiplier - D.J. Healey III
- 11-29-237 A Rapid and Simple In-Process Test Method Designed to Improve Quality of Quartz Resonators in Current Demand Today - P.E. Bryan
- 11-29-270 Test Set for the Measurement of Transmitter Stability Parameters - J.M. Milan
- 11-29-394 A Time Domain Method for Measurement of the Spectral Density of Frequency Fluctuations at Low Fourier Frequencies - P. Lesage and C. Audoin
- 11-29-404 Picosecond Time Difference Measurement System - D.W. Allan and H. Daams
- 11-29-412 Timekeeping and the Reliability Problem - D.B. Percival and G.M.R. Winkler
- 11-29-425 NTS-1 (Timation III) Quartz and Rubidium Oscillator Frequency Stability Results - T.B. McCaskill and J.A. Buisson
- 11-30-92 Implementation of Bridge Measurement Techniques for Quartz Crystal Parameters - E. Hafner and W.J. Riley
- 11-30-269 Design Considerations in State-of-the-Art Signal Processing and Noise Measurement Systems - F.L. Walls, S.R. Stein, J.E. Gray, D.J. Glaze and D.W. Allan
- 11-30-309 System for Automatic Phase Noise Measurement - L. Peregrino and D. Ricci
- 11-31-78 Methods for Production Screening for Anomalous Responses in Quartz Crystals Intended for High Reliability Applications - P.F. Godwin, Jr. and G.L. Snider
- 11-31-96 Extending the Frequency Range of the Transmission Line Method for the Measurement of Quartz Crystals Up to 250 MHz - R. Fischer and L. Schulzke
- 11-31-102 Ovenless Activity Dip Tester - A.D. Ballato and R. Tilton
- 11-31-108 Measurement of the Characteristic Frequency of an AT-Cut Plate - J.H. Sherman, Jr.
- 11-31-117 A New Quality Evaluation Method of Raw Quartz by Measuring the Q-Value of Y-Bar Resonator - H. Fukuyo, N. Oura and F. Shishido
- 11-31-291 Oscillator Specifications: A Review of Classical and New Ideas - J. Rutman
- 11-31-302 Specification and Measurement of Oscillator Phase Noise Instability - W.C. Lindsey and C.M. Chie
- 11-31-311 Estimation of the Two-Sample Variance with a Limited Number of Data - P. Lesage and C. Audoin
- 11-31-319 Prediction Error Analysis of Atomic Frequency Standards - D.B. Percival
- 11-31-327 Models and Predictions for the Realization of Time Scales - U. Hubner
- 11-31-335 Accurate Measurements of Spectral Density of Phase Noise in Devices - F.L. Walls and S.R. Stein
- 11-31-344 Frequency and Time Domain Stability of A Progress Report - J. Vanier, M. Tetu and R. Brousseau
- 11-31-347 Automating Phase Noise Measurements in the Frequency Domain - A.L. Lance, W.D. Seal, F.G. Mendoza and N.W. Hudson
- 11-32-326 Derivation of a Leak Specification for a Hermetic Envelope - J.H. Sherman, Jr.
- 11-32-334 Crystals and NMOS: Frequency Controlled MPU's - J.J. Farrell
- 11-32-337 The Measurement of Load Resonance Characteristics of Quartz Crystals Using the Zero Phase II-Network - S.J. Hughes, R.W. Parfitt and J.S. Hardy

# CATEGORY 11 (Cont'd):

- 11-32-344 Results of Temperature Slewing Quartz Crystals for Anomalous Responses - M.B. Bloch, M.P. Meirs and A. Strauss
- 11-32-354 Automatic Microcircuit Bridge Measurements on Quartz Crystal Units - G.J. Malinowski and E. Hafner
- 11-32-432 A Technique for a Self Phase Noise Measuring System for Signal Sources - B. Parzen and J.P. Hou
- 11-33-110 A High-Sensitivity AC Dilatometer for the Direct Measurement of Piezoelectricity and Electrostriction - K. Uchino and L.E. Cross
- 11-33-159 A Four-Frequency Process for Accurately Measuring Coupled-Dual Resonator Crystals - G.E. Roberts
- 11-33-176 A Review of the New IEEE Standard on Piezoelectricity - T.R. Meeker
- 11-33-181 Trim Sensitivity - A Useful Characterization of a Resonator - J.H. Sherman, Jr.
- 11-33-186 New Metal Enclosures for Resistance Welding Developed to Meet Mil-Specifications - D. Fuchs and K.H. Mucke
- 11-33-189 Quartz Crystal Measurements by a 'Phase-Amplitude' Method - W.D. Beaver, W.E. Van Loben Sels and M. Wang
- 11-33-201 Automatic Measurement of Parameters of VHF Quartz Crystal Resonators - Y. Tsuzuki, M. Toki, T. Adachi and H. Yanagi
- 11-35-263 The Quartz Resonator Automatic Aging Measurement Facility - D.E. Beetley, B.R. Blitch and T.M. Snowden
- 11-35-271 Comparison of Methods for Measurement of Quartz Crystal Resonators With Load Capacitance - W.H. Horton, T.S. Payne, R.C. Smythe and D.A. Symonds
- 11-35-280 An Automated Resonator Measurement System Using a Reflection Coefficient Bridge - R.C. Smythe
- 11-35-286 Implementation of an Automatic Microcircuit Measuring System for Quartz Crystals - G.J. Malinowski, C. Nyholm and G.L. Snider
- 11-35-458 Characterization of Frequency Fluctuations by Crosscorrelations and By Using Three or More Oscillators - J. Gros Lambert, D. Fest, M. Olivier and J.J. Gagnepain
- 11-35-464 An Ultra-High Resolution Frequency Meter - J.J. Snyder
- 11-35-470 A Modified "Allan Variance" With Increased Oscillator Characterization Ability - D.W. Allan and J.A. Barnes
- 11-36-297 New Method for the Measurement of Quartz Crystal Resonator Parameters - R.C. Peach, A.J. Dyer, A.J. Byrne and S.P. Doherty
- 11-36-302 An Instrument for Automated Measurement of the Angles of Cut of Doubly Rotated Quartz Crystals - J.L. Chambers
- 11-36-314 Performance of an Automated High Accuracy Phase Measurement System - S.R. Stein, D.J. Glaze, J. Levine, J.E. Gray, D. Hilliard, D.A. Howe and L. Erb
- 11-36-321 A Frequency Domain Reflectometer for Quartz Resonator Investigations - C.S. Stone and O.J. Baltzer
- 11-36-480 Theoretical and Practical Effects of the Resonator Specifications and Characteristics upon Precision Crystal Oscillator Design and Performance - B. Parzen
- 11-37-187 Improvements of Laser Interferometric Measurement System of Vibration Displacements - T. Adachi, M. Okazaki and Y. Tsuzuki
- 11-37-275 An Instrument for Automated Measurement of the Angles of Cut of Doubly Rotated Quartz Crystals - J.L. Chambers
- 11-37-284 A Measurement Technique for Determination of Frequency vs Acceleration Characteristics of Quartz Crystal Units - D.J. Healey III, H. Hahn and S. Powell
- 11-37-290 Evaluation of Crystal Measurement Systems - R.C. Smythe and W.H. Horton
- 11-37-297 A New Frequency for Piezoelectric Resonator Measurement - W.H. Horton and R.C. Smythe
- 11-37-300 Measuring Method of Equivalent Series Capacitance and Negative Resistance of Quartz Crystal Oscillator Circuits - M. Toki, Y. Tsuzuki and T. Mitsuoka
- 11-37-306 S.Y. Parameters Method for Accurate Measurement of Bulk Wave Crystal Resonators at Frequencies up to 2 GHz - J.P. Aubry, E. Gerard and S. LeChopier
- 11-37-506 A New Frequency Calibration Service Offered by the National Bureau of Standards - G. Kamas and J.L. Jespersen

# CATEGORY 11 (Cont'd):

- 11-37-513 Specifying Performance for Atomic Standards - J.D. White
- 11-37-516 Platform Distribution System Specifications - J.A. Murray
- 11-37-519 Modernization of the Military Specification for Quartz Crystal Units - R.L. Filler
- 11-37-524 Revision of the Military-Specification for Quartz Crystal Oscillators - V.J. Rosati and S. Schodowski
- 11-37-525 Review of New Military Specification on Surface Acoustic Wave Devices - E.A. Mariani
- 11-38-483 Software for Two Automated Time Measurement Systems - S.R. Stein and G.A. Gifford
- 11-38-487 The Specification of Quartz for Piezoelectric Devices - J.C. Brice
- 11-38-496 X-Ray Handedness Determination on Finished Doubly Rotated Quartz Plates - H. Merigoux, J.F. Darces and J. Lamboley
- 11-38-499 Resistance-Measurements of Quartz Crystals at Very Low Drive Levels - J.S. Yerna
- 11-38-507 Further Results of Temperature Compensated Crystal Oscillator Testing - V.J. Rosati and P.L. Thompson
- 11-39-132 Application of Spectrum Estimation in Phase Noise Measurement - D. Wulin and X. Sanbao
- 11-39-527 A System for Precision Parameter Measurements on Quartz Crystal Resonators and Bipoles - R.C. Peach and S.E. Morris
- 11-39-535 Investigation of Quartz Crystal Thickness Shear and Twist Modes Using a New Noninterferometric Laser Speckle Measurement Method - S. Hertl, E. Benes, L. Wimmer and M. Schmid
- 11-39-544 A Study of Flexural, Anharmonic and Thickness-Shear Modes of Vibrations in Quartz Resonators Using Scanning Electron Microscope - H. Bahadur and R. Parshad
- 11-40-295 Group Delay Measurements - A Sensitive Method For Detecting Spurious Crystal Resonances - F.K. Euler
- 11-40-306 Aging Measurements on Quartz Crystals in the Batch Mode - E. Hafner and H.W. Jackson
- 11-40-313 The Precise Determination by an Automatic System on the Resonance Frequencies of the Quartz Crystal Resonator - Y. Oomura and Y. Watanabe
- 11-40-323 Report on the Workshop on Traceability of Quartz Measurements to U.S. Standards - J.A. Kusters
- 11-41-126 A Method for Using a Time Interval Counter to Measure Frequency Stability - C.A. Greenhall
- 11-41-241 Cultured Quartz Quality Standards Updated by the EIA - C.B. Sawyer
- 11-41-466 Review of the Revised Military Specification for Quartz Crystal Oscillators - S. Schodowski and V.J. Rosati
- 11-41-527 Progress Report on the EIA/P.11 Round Robin Crystal Measurements Experiment - W.L. Smith
- 11-42-304 A Simple Way of Characterizing High Q Oscillators - J. Goldberg
- 11-42-380 Measurement and Analysis of Thermal Hysteresis in Resonators and TCXO's - R.L. Filler
- 11-42-419 Standard Terminology for Fundamental Frequency & Time Metrology - D.W. Allan, H. Hellwig, P. Kartaschoff, J. Vanier, J.R. Vig, G.M.R. Winkler and N.F. Yannoni
- 11-42-432 Extending the Range and Accuracy of Phase Noise Measurements - F.L. Walls, A. Clements, C.M. Felton, M. Lombardi and M. Vanek
- 11-42-442 Technique for Measuring the Acceleration Sensitivity of SC-Cut Quartz Resonators - M. Watts, E.P. EerNisse, R.W. Ward and R.B. Wiggins
- 11-42-456 Precise Measurements of Quartz Crystal Units by Network Analyzer Technique Applied to Two Different Types of Test Jig - V. Popovic-Milovanovic, B. Dobnikar and V. Popovic

## CATEGORY 12:

### Frequency Stability and Phase Noise (other than "measurement of")

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| <p>12-10-390 Long and Short Term Frequency Stability of UHF Cavity-Controlled Oscillators - R.E. Meek</p> <p>12-14-192 Stability of Crystal Oscillators - E. Hafner</p> <p>12-16-438 The Effects of Noise on Oscillator Frequency Stability - L. Saporta and G. Weiss</p> <p>12-16-448 Measurements on Oscillator Stability Improvement by Means of High Purity Nickel Cathode Tubes - C.J.G. Abom</p> <p>12-18-535 Short Term Stability of High Precision Crystal Oscillators - M.B. Bloch and K. Toerper</p> <p>12-19-43 Progress and Problems in Short Term Stability - W.A. Edson</p> <p>12-21-259 Present Status in Short Term Frequency Stability - L.S. Cutler</p> <p>12-21-264 Study of Short Term Stability of Crystal Oscillator - B. Boychuk, M.B. Bloch, G. Weiss and A. Thumin</p> <p>12-22-340 Flicker Noise of Phase in RF Amplifiers and Frequency Multipliers: Characterization, Cause and Cure - D. Halford, A.E. Wainwright and J.A. Barnes</p> <p>12-28-150 Phase Noise of Various Oscillators at Very Low Fourier Frequencies - D. Babitch and H. Fallek</p> <p>12-28-160 Relations Between Spectral Purity and Frequency Stability - J. Rutman</p> <p>12-28-166 On 1/f-Noise in Diodes and Transistors - O. Mueller</p> <p>12-28-243 A Method for Estimating the Frequency Stability of an Individual Oscillator - J.E. Gray and D.W. Allan</p> <p>12-29-308 1/f Resonant Frequency Fluctuation of a Quartz Crystal - T. Musha</p> <p>12-29-311 Internal Noise of a Quartz Crystal Oscillator, Influence of the Parallel Capacitance - R. Brendel, J. Gros Lambert, G. Marianneau, M. Olivier and J. Uebersfeld</p> <p>12-30-284 The Stability of Precision Oscillators in Vibratory Environments - A.I. Vulcan and M.B. Bloch</p> <p>12-32-514 Conversion Between Time and Frequency Domain of Intersection Points of Slopes of Various Noise Processes - R. Burgoon and M.C. Fischer</p> | <p>12-32-520 Transfer of Frequency Stability From an Atomic Frequency Reference to a Quartz Crystal Oscillator - J. Vanier, M. Tetu and L.G. Bernier</p> <p>12-32-527 A Systems Approach to High Performance Oscillators - S.R. Stein, C.M. Manney, Jr., F.L. Walls, J.E. Gray and R.J. Besson</p> <p>12-32-542 Estimation of the Spectrum of Fractional Frequency Deviates - D.B. Percival</p> <p>12-34-228 Application of Modern Time Series Analysis to High Stability Oscillators - B.F. Farrell, E.M. Mattison and R.F.C. Vessot</p> <p>12-35-476 Relation Between 1/f Noise and Q-Factor in Quartz Resonators at Room and Low Temperatures, First Theoretical Interpretation - J.J. Gagnepain, J. Uebersfeld, G. Goujon and P. Handel</p> <p>12-35-484 1/f Frequency Fluctuation of a Quartz Crystal Oscillator and Temperature Fluctuation - Y. Noguchi, Y. Teramachi and T. Musha</p> <p>12-36-371 Vibration and Acceleration-Induced Timing Errors of Clocks and Clock Systems - F.L. Walls</p> <p>12-37-218 Excess Noise in Quartz Crystal Resonators - J.J. Gagnepain, M. Olivier and F.L. Walls</p> <p>12-38-319 Simulation of Oscillator Noise - J.A. Barnes</p> <p>12-39-91 Errors in Servo Systems Using Sinusoidal Frequency (Phase) Modulation - F.L. Walls</p> <p>12-39-97 1/f Frequency Fluctuations in Acoustic and Other Stable Oscillators - T.E. Parker</p> <p>12-39-113 The Fractal Dimension of Phase and Frequency Noises: Another Approach to Oscillator Characterization - J.J. Gagnepain, J. Gros Lambert and R. Brendel</p> <p>12-39-119 Frequency Stability Characterization From the Filtered Signal of a Precision Oscillator - P. Tremblay and M. Tetu</p> <p>12-39-127 The Analytic Signal Representation of Oscillators with Application to Frequency Stability Analysis - L.G. Bernier and F.E. Gardiol</p> <p>12-39-135 A Comparison of Frequency Noise of Quartz Resonators - J.J. Gagnepain</p> <p>12-40-241 Random Walk Frequency Fluctuations In Saw Oscillators - T.E. Parker</p> |
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CATEGORY 12 (Cont'd):

- 12-40-300 RF Spectrum of the Oscillator Signal  
Under Non-Stationary Phase  
Instabilities - B. Joss, L.G.  
Bernier and F.E. Gardiol
- 12-40-336 Minimum Sideband Noise in  
Oscillators - J.K.A. Everard
- 12-40-379 The Coherence of a Radar Master  
Oscillator - R.D. Weglein
- 12-41-99 Characteristics and Sources of Phase  
Noise in Stable Oscillators - T.E.  
Parker
- 12-41-112 Relating the Allan Variance to the  
Diffusion Coefficients of a Linear  
Stochastic Differential Equation  
Model for Precision Oscillators -  
J.W. Chaffee
- 12-41-116 Theoretical Analysis of the Modified  
Allan Variance - L.G. Bernier
- 12-41-122 Frequency Stability Characterization  
of Hopping Sources - G.A. Kalivas  
and R.G. Harrison
- 12-41-420 The Relationship Between Resonator  
and Oscillator Noise, and Resonator  
Noise Measurement Techniques - G.S.  
Curtis
- 12-41-471 Noise in Oscillators Employing  
Submicron Field-Effect Transistors -  
M.S. Gupta
- 12-41-507 Random Noise in Digital Gates and  
Dividers - D.E. Phillips
- 12-42-279 The Influence of Pressure and  
Humidity on the Medium and Long-Term  
Frequency Stability of Quartz  
Oscillators - F.L. Walls
- 12-42-389 Burst Noise and 1/F Noise in Quartz  
Crystals and Oscillators - G.  
Moulton
- 12-42-397 Resonator Surface Contamination - A  
Cause of Frequency Fluctuations? -  
Y.K. Yong and J.R. Vig
- 12-42-426 Noise and Time and Frequency --- A  
Potpourri - J.A. Barnes
- 12-42-447 Kalman Filter Analysis for Real Time  
Applications of Clocks and  
Oscillators - S.R. Stein



### CATEGORY 13:

#### Sensors and Transducers

- 13-31-62 Quartz Crystal Accelerometer  
Insensitive to Temperature Variation  
- M. Onoe, K. Furusawa, S. Ishigami,  
T. Sase and M. Sato
- 13-36-265 The Torsional Tuning Fork as a  
Temperature Sensor - R.J. Dinger
- 13-36-290 New Quartz Resonators with Precision  
Frequency Linearity over a Wide  
Temperature Range - M. Nakazawa, H.  
Ito, A. Usui, A.D. Ballato and T.J.  
Lukaszek
- 13-37-248 Force Sensor Using Double-Ended  
Tuning Fork Quartz Crystals - S.S.  
Chuang
- 13-38-233 Force Sensing Using Quartz Crystal  
Flexure Resonators - W.C. Albert
- 13-38-240 Stress-Compensated Quartz Resonators  
Having Ultra-Linear Frequency-  
Temperature Responses - M. Nakazawa,  
H. Yamaguchi, A.D. Ballato and T.J.  
Lukaszek
- 13-39-556 Enhanced Composite Resonator  
Analysis and its Application to the  
Quartz Crystal Microbalance - E.  
Benes, K.C. Harms and G. Thorn
- 13-39-571 Transient Analysis of Piezoelectric  
Transducer Response - A.H. Banah
- 13-39-575 A Filled Thermal System Utilizing A  
Gas Density Sensing Quartz Crystal  
Tuning Fork - R.W. Ward and E.P.  
EerNisse
- 13-40-211 A Quartz Fluid Density Sensor  
Pressure Transducer - R.W. Ward and  
E.P. EerNisse
- 13-40-216 A Resonator Temperature Transducer  
with No Activity Dips - E.P.  
EerNisse and R.B. Wiggins
- 13-40-224 Temperature Sensor Using quartz  
Tuning Fork Resonator - T. Ueda, F.  
Kohsaka, T. Iino and D. Yamazaki
- 13-40-230 Double-Ended Tuning Fork Quartz  
Accelerometer - W.J. Kass and G.S.  
Snow
- 13-40-237 An Economical Touch Panel Using Saw  
Absorption - R. Adler and P.J.  
Desmares
- 13-41-333 New Prospects for Acoustic Sensors:  
An Overview - R.M. White
- 13-41-339 Theoretical Modeling of Quartz  
Resonator Pressure Transducers -  
E.P. EerNisse
- 13-41-344 A Reduced Hysteresis, Extended Range  
Quartz Pressure Transducer - R.W.  
Ward and E.P. EerNisse
- 13-41-350 Study of Liquids in Shear Using a  
Quartz Resonator - K.K. Kanazawa and  
C.E. Reed
- 13-41-544 A High Linearity SAW Accelerometer -  
D.E. Bower, M. Cracknell and A.  
Harrison
- 13-42-78 A Low Cost Force Sensing Crystal  
Resonator Applied to Weighing - W.  
Albert

# CATEGORY 14:

## Other Topics

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|--|--|
| 14-10-455 A Transistorized 1 Mc/Sec Frequency Counter - N. Sher and R. Goodwin   | 14-23-313 Precision Time Measurements of Optical Pulsars - P. Boynton, R.B. Partridge and D.T. Wilkinson   |
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